




1827-1927

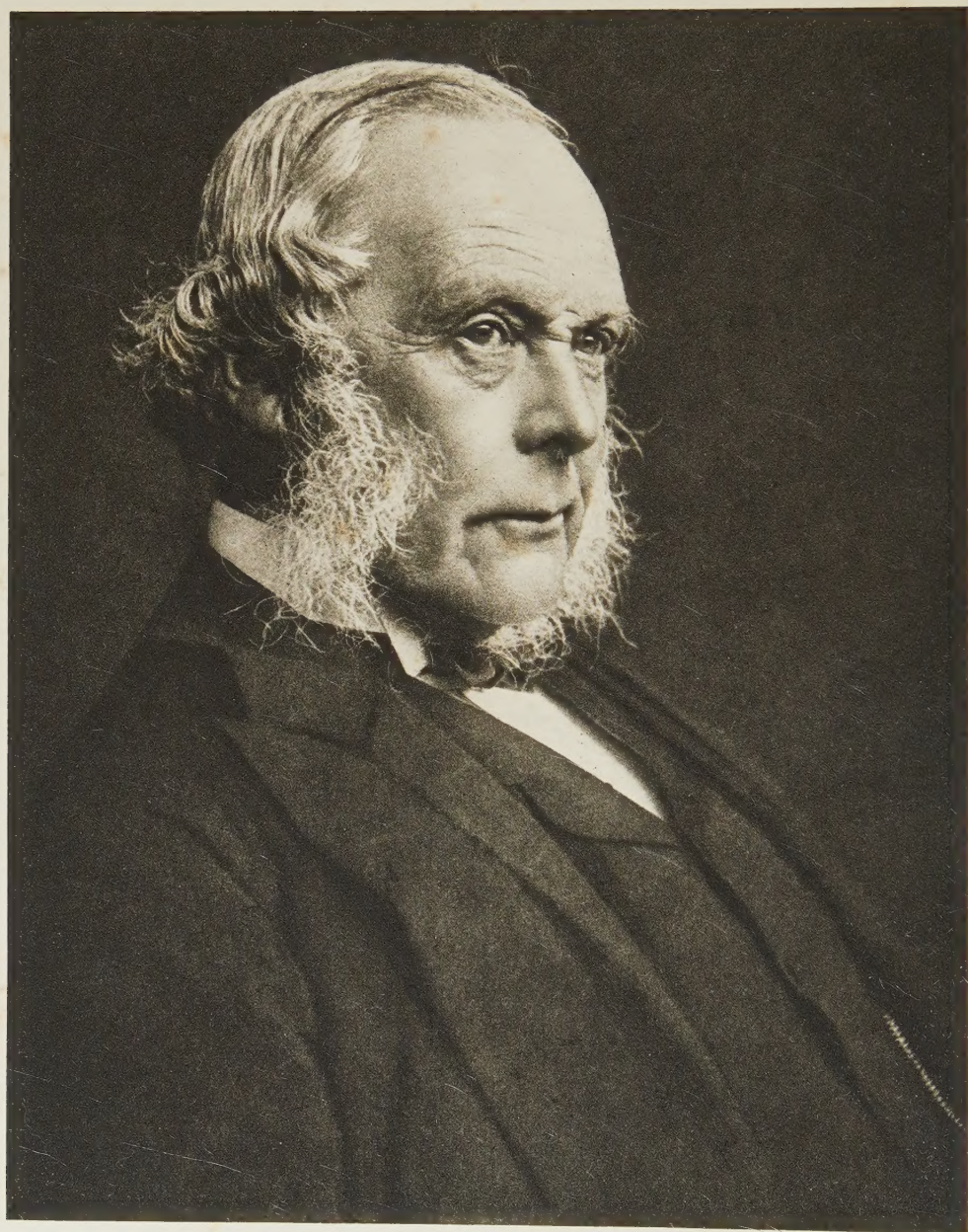
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JOSEPH, BARON LISTER



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From a photograph by Mr. R. A. Bicknorstein F.R.C.S.

Lister

JOSEPH, BARON LISTER

CENTENARY VOLUME

1827-1927

*Edited for the Lister Centenary Committee of the
British Medical Association*

His brow spreads large and placid, and his eye
Is deep and bright, with steady looks that still.
Soft lines of tranquil thought his face fulfill—
His face at once benign and proud and shy.
If envy scout, if ignorance deny,
His faultless patience, his unyielding will,
Beautiful gentleness and splendid skill,
Innumerable gratuities reply.
His wise, rare smile is sweet with certainties,
And seems in all his patients to compel
Such love and faith as failure cannot quell.
We hold him for another Herakles,
Battling with custom, prejudice, disease,
As once the son of Zeus with Death and Hell.

WILLIAM ERNEST HENLEY,
A Book of Verses.

OLIVER AND BOYD
EDINBURGH: TWEEDDALE COURT
LONDON: 33 PATERNOSTER ROW, E.C.

1927

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BY

A. LOGAN TURNER, M.D., LL.D. Edin.

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The Clarendon Press, Oxford, for permission to reproduce from the Third Edition of Sir Rickman Godlee's "Lord Lister" the Original Model of Sir Thomas Brock's Medallion in Westminster Abbey, facing page 598, and the Frontispiece portrait of Lord Lister, from the same volume.

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FOREWORD

FIFTEEN years have elapsed since the civilised world mourned the passing of one of the supreme benefactors of mankind. To-day the world is reminded that Lister still lives in the thoughts and hearts of the human race, which once more desires to pay its tribute to his great achievement and to his ineffaceable memory, by celebrating the centenary year of his birth.

Edinburgh captivated and held the young surgeon when, on the threshold of his career, he first crossed the Tweed. The fame of her University and School of Medicine as teaching institutions; the notable group of men who, at the time of his arrival, shed lustre upon the School; the Royal Infirmary with its ample equipment of surgical beds offering unrivalled opportunities for the study of disease; the stimulating effect derived from contact with a large body of students and the more than cordial reception extended to him by James Syme, all created an inspiring atmosphere which exercised a profound influence on Lister's mind. He became more and more impressed with the advantages which the city offered, and in it he found abundant occupation of an intensely interesting character. His decision to remain was inevitable, and for Edinburgh and her Medical School he acquired an affection and an admiration which he retained throughout his long life.

It is fitting and natural, therefore, that Edinburgh should associate herself with the universal desire to pay homage to his memory in this centennial year.

Foreword

In the summer of 1926, a Committee, presided over by Professor John Fraser, and representative of the medical profession in the city, was appointed to consider the steps that should be taken to commemorate the centenary of the birth of Lord Lister. It was resolved that the Lister Celebration should be held in July 1927, during the Meeting of the British Medical Association in Edinburgh, a proposal which met with the unqualified approval of the officials of the Association.

After further consideration the Committee decided that the occasion would be appropriately recognised along the following lines:—A Commemorative Ceremony in the McEwan Hall of the University; an Exhibition of Lister Relics; the publication of a Lister Memorial Volume; the award of a Prize and Gold Medal for the best essay upon "The Influence of Lister upon Surgery," open to students and recent graduates of all the Medical Schools in the British Empire; and the placing of an inscription upon the two houses occupied by Lister during his residence in the city.

The Commemoration in the McEwan Hall was arranged for the evening of Wednesday, 20th July, at 8 o'clock, and the Earl of Balfour, K.G., O.M., Chancellor of the University of Edinburgh, graciously consented to preside and address the Meeting.

The programme was also to include a series of short orations, relative to Lister and his work, by two of his former House Surgeons, Sir William Watson Cheyne, Bt., London, and Professor John Stewart, Halifax, N.S.; by Professor Tuffier of Paris, representing the country of Pasteur, and by Professor Harvey Cushing of Harvard University, as representative of the United States of America.

Foreword

The Exhibition of Lister Relics forms a distinctive feature of the celebration, and, through the courtesy of the members of the University Court, arrangements have been made for their display in the Upper Library Hall of the Old University. In the later years of his life, Lister gave practical expression to the strong feeling of regard which he entertained towards the Edinburgh School of Medicine, by presenting the University with a number of his most valued possessions ; his portrait by Mr J. H. Lorimer, R.A., his diplomas and gold medals and the caskets containing the Scrolls of the Freedom of three cities, Edinburgh, London and Glasgow. These form one of the most interesting sections of the collection, and the story of how they came to be handed over to the University is told in the Letters to Principal Sir William Turner, which are reproduced in this volume.

The Committee is greatly indebted to the generous assistance given by the Founder and Director and by the Staff of the Wellcome Historical Medical Museum, London. Through their liberality and co-operation the Exhibition has acquired a completeness which otherwise it would not have had.

The Lister Memorial volume appears, with the sanction of the officials of the British Medical Association, in place of "The Book of Edinburgh, 1927." In its present form it constitutes a distinct departure from the customary volume descriptive of the city and its neighbourhood, issued in connection with the Association's Meetings. The exceptional character of the occasion, however, fully justifies the change from this long established procedure. In the writers selected and in the character of their articles, an Edinburgh "atmosphere" has been appropriately introduced.

In the Lister volume no serious attempt has been made

Foreword

to reconstruct a consecutive story of his life and work. This has been admirably done elsewhere. It has been sufficient merely to give a biographical sketch of Lister's career. The main idea underlying the preparation of the book has been to reproduce, partly by transcribing his own words and partly through the language of others, the surgical conditions of the period, his labours to solve the problem of sepsis, and the successful realisation which attended his efforts. In the series of pen-pictures by those who were closely associated with him, it is possible to obtain an impression of the nobility of his nature, of his sympathy, his gentleness and modesty. In these reminiscences are vividly portrayed his constant preoccupation, his perseverance and ceaseless efforts, his passion for truth and ascertained fact, and throughout all, his complete confidence, in spite of all opposition, in the ultimate universal acceptance of the great principle on which he founded the antiseptic system.

By the death of Professor Francis M. Caird in November 1926, the Committee was deprived, early in its work, of the valuable assistance of one of its most useful members. His intimate knowledge of Lister's associations with Edinburgh during his tenure of the Chair of Clinical Surgery, was freely put at the Committee's disposal. One of Mr Caird's last acts was to place on record the impressions he retained of his former teacher and life-long friend, and the Lister volume is, in consequence, enriched by this contribution from his pen.

THE EDITOR.

CHRONOLOGY

Born—5th April 1827, at Upton, Essex.

London—1st Period, 1844-1853.

Entered University College, London, 1844.

Graduated B.A., University of London, 1847.

House Physician and House Surgeon, University College Hospital, 1851.

Graduated M.B., University of London, 1852.

Fellow of the Royal College of Surgeons of England, 1852.

Edinburgh—1st Period, 1853-1860.

House Surgeon to Professor Syme, 1854-1855.

Fellow of the Royal College of Surgeons of Edinburgh, 1855.

Lecturer on Surgery, Edinburgh School of Medicine, 1855.

Assistant Surgeon, Royal Infirmary, 1856.

Glasgow—1860-1869.

Regius Professor of Surgery, University of Glasgow, 1860.

Surgeon to Royal Infirmary, Glasgow, 1861.

Edinburgh—2nd Period, 1869-1877.

Regius Professor of Clinical Surgery, University of Edinburgh, 1869.

Surgeon, Royal Infirmary, Edinburgh, 1869.

London—2nd Period, 1877-1900.

Professor of Clinical Surgery, King's College, 1877-1892.

Surgeon to King's College Hospital, 1877-1893.

President of the Royal Society, 1895-1900.

President of the British Association for the Advancement of Science, Liverpool, 1896.

Died—10th February 1912, at Walmer, Kent.

JOSEPH, BARON LISTER

I

BIOGRAPHICAL SKETCH (1827-1912)

IN the early part of the nineteenth century there were born, within a few years of each other, three men to whom modern Surgery is indebted for two great advances—Anæsthesia and the Antiseptic System. These men were: James Young Simpson (1811), Louis Pasteur (1822), and Joseph Lister (1827). Of the youngest of this great triumvirate—Joseph Lister—I have been asked to write a short biographical notice, doubtless because it was my good fortune and happiness to work under and for him in the Old Infirmary, Edinburgh, as “dresser,” “clerk,” and as “house-surgeon,” in 1871, 1872, and 1873, years during which he was developing and perfecting the technique of his system of Antiseptic Surgery inaugurated in 1865 in the Glasgow Royal Infirmary.

Parentage, Childhood and Boyhood

Assuming the correctness of the adage that “the child is father of the man,” a few words are needed as to Lister’s parentage, childhood and boyhood. Joseph Lister, the child of Quaker parents, was born on 5th April 1827, at Upton, a small country hamlet in the west of Essex. He was the second son of Joseph Jackson Lister, of Yorkshire stock, who was in business as a merchant in London, but had his residence at Upton House. He had purchased this old Queen Anne mansion, being attracted to it by its gardens

Joseph, Baron Lister

and the extensive country fields by which it was surrounded, and by the fact that a number of other Quaker families lived at Upton. The house still remains as the Vicarage of St Peter's Church, but is now surrounded by ordinary industrial dwellings, as London, well termed the "City of Villages," has absorbed with her overflowing population the once country hamlet.

It was amidst these pleasant rural surroundings that Lister's early childhood was spent, awakening in him that love of Nature which he always manifested, and giving him a healthy, bright and happy existence; for the Quaker régime, though vetoing "vain sports and places of diversion," had nothing dismal or Puritanic about it. The years of childhood had their home education under the watchful eye of a father whose mind had a scientific trend, for it is to him we owe the first perfect achromatic microscope, his optical skill having, as his son said subsequently, "raised the compound microscope from little better than a toy to a powerful engine for investigation." This early education was, of course, subsequently supplemented by instruction at two private Quaker schools, the first at Hitchin and the second at Grove House, Tottenham, the educational system of both being typical of the fundamental and leading principles of Quakerism.

Lister remained at Grove House until his seventeenth year, and he left this establishment with his powers of observation and reading strengthened, with considerable linguistic facility in French and German, and with great aptitude for Classics. He had also, under his father's tuition, some practical experience in the use of the microscope, and with section cutting, so that he was scholastically well prepared for the University life he was soon to enter on. These youthful days also saw manifested in Lister the affectionate



UPTON HOUSE, UPTON, ESSEX, 1827.

The house and park at the time of Joseph Lister's birth.

Biographical Sketch

nature and the love of home which he showed all through life ; there was strongly engendered in him also the Quaker creed that life was to be devoted to the good of mankind, and that in all its affairs there should be kindness and consideration for others. Thus, in Lister's early years there were well and truly laid the foundations of the thoughtfulness, the courteous manner, the dignified bearing, that were so characteristic of the man ; also the singleness of aim, the attention to detail, the resolute courage, that marked the personality of the surgeon of later days, and enabled him to accomplish in the face of much opposition the end for which he strove.

Student Days in London

Having definitely, and with his father's consent, decided on Medicine as a profession, Lister went to University College, London, in the spring of 1844, joining first the Arts Course, as his father deemed this desirable before commencing his medical studies. In 1845, he matriculated with distinction in Botany and Classics, obtaining his B.A. degree in 1847, but without honours or gold medals ; thus his Arts course was not marked by any prominent success. In fact, these three years of study seemed to have been a severe mental strain on him, and he had a nervous breakdown.

A holiday in Ireland completely restored him to health, and, in the winter session of 1848, when 20 years of age, Lister commenced the study of Medicine at University College Medical School and Hospital. He soon showed himself to be a hard worker and an original thinker, and quickly took a leading place amongst his fellow-students, while his brilliant success at examinations marked him out for future distinction. As one of his tutors said of him : "He excels anyone I know or have known, in his bright

Joseph, Baron Lister

promise for the future,"—a happy forecast of him that was amply fulfilled. At his first examination, he won two out of four gold medals for which he was eligible, and in 1852, when he took the M.B. degree of the University of London, with honours, he not only obtained distinction in other subjects but secured the Gold Medal and Scholarship in Surgery, thus placing University College second in the list of London Medical Schools for the years 1849-50, Guy's being first. In 1852, Lister also became a Fellow of the Royal College of Surgeons of England.

Before qualifying, Lister was House Physician to Dr Walshe, and, in 1851, House Surgeon to Mr Erichsen. His resident life in hospital was, in many ways, advantageous to him, rendering him brighter and happier, as was shown in his activities in the Debating Society and in the Hospital Medical Society. To the latter, he communicated two papers, one on "Gangrene," and the other on "The Use of the Microscope in Medicine." Subsequently, in 1853, he published two papers which showed his facility in the use of the microscope and a third which gave the results of some physiological experiments. These investigations point clearly to the bent of Lister's mind, and they indicate also the active originality and keen perception which made themselves so manifest in after years. At this period of his life also, Lister, as House Surgeon, made his first actual acquaintance with hospital gangrene and the other fatal sequelæ of operations, and, realising the slur they cast on surgery, he felt the first promptings of that determination to grapple with the evil and to overcome it, a resolution which, eventually, constituted the main object of his life's work.

On all these grounds, then, it is a fair conclusion to draw, that Lister's residence in hospital was most salutary and beneficial to him. Not only did he share the enthusiasm

Biographical Sketch

that animated the able band of his fellow-residents, many of whom afterwards won distinction in medicine and surgery, and as teachers; but he relinquished his appointment with broader views and a more enlightened outlook on life, its aims and obligations, without losing anything of the high standard of conduct or of the deep religious beliefs that regulated his daily life.

Introduction to Mr Syme and Residence in Edinburgh

At the conclusion of this period, it was decided, mainly on the advice of Professor Sharpey, with whom he had been a favourite pupil, that, before settling down in London as a consulting surgeon, he should spend a month in Edinburgh, attending the surgical clinic of Mr Syme, and thereafter making a tour of the continental hospitals with the view of enlarging his experience. Lister was now 26 years of age, and was described as a man of average height and of slender build, but with a well-proportioned frame. His head was large and intellectual, with a lofty brow and a calm, earnest face. His hair was dark and luxuriant, and he had the side whiskers then in vogue. Dressed in black, with the usual Quaker type of garment, he presented an impressive appearance, which, however, was relieved by features indicative of thoughtfulness, sincerity and kindness.

In September 1853, Lister came to Edinburgh and presented Sharpey's letter to Professor Syme. He was received with great cordiality, and Syme at once evinced a special interest in his visitor. He took steps to make him fully acquainted with his methods of teaching and gave him some hospital and private work to do. Attracted by Syme's ability as a surgeon and by the great efficiency of

Joseph, Baron Lister

the Edinburgh School of Medicine, with its ample supply of clinical material in its 200 surgical beds, Lister, at the end of the month's visit, decided to pass the winter session in Edinburgh. With this arrangement Syme was in full accord, and he made him a "supplemental clerk" to his wards in the Infirmary, the duties being to assist at operations and make clinical reports on the cases. In January 1854, when his House-Surgeoncy unexpectedly became vacant, Syme, who had formed a high opinion of Lister's capabilities, appointed him to the post, giving him considerable freedom in operating and in the care of the patients.

Lister entered on his new duties with eagerness and pleasure; he readily accepted the responsibility now placed on him, and he gave special attention to the instruction of his twelve dressers, who, in their turn, were greatly attracted to him. They spoke of him as "The Chief," a term of regard and admiration by which subsequently he was always known. In the same year other events occurred which proved a turning-point in Lister's career. In November 1854, news came to Edinburgh of the death in the Crimea of Dr Mackenzie, an assistant surgeon in the Infirmary and lecturer in surgery in the Royal College of Surgeons.

Mackenzie had established a reputation in Edinburgh as a brilliant surgeon, and was considered the future hope of the Edinburgh Medical School, so that his death was keenly felt, and interest was aroused in finding a worthy successor to him. Those who knew Lister saw in him the man, and pressure was put on him to fill the vacancy at the College of Surgeons, and to seek election as Assistant-Surgeon to the Infirmary. A good deal hung on the decision, but eventually, with the consent of his father and with Syme's approval, he decided to abandon a London

Biographical Sketch

career and settle in Edinburgh. Accordingly, he secured Mackenzie's lecture room at 4 High School Yards, and, at the termination of his House-Surgeoncy in February 1855, he took residential and consulting rooms at 3 Rutland Street, opposite Syme's consulting room, and began his Edinburgh professional life as a consulting surgeon.

Lister fully appreciated the social advantages of Millbank House, Syme's lovely residential home, where he had the opportunity of meeting the many celebrated surgeons who visited there. This period in Lister's life was one of contentment and happiness, which was greatly augmented by his engagement to Syme's eldest daughter, Miss Agnes Syme, to whom, after resigning his membership of the Society of Friends, he was married in April 1856, the union proving a most happy one. The honeymoon was spent in carrying out the tour of continental hospitals, that had been previously relinquished. He returned to Edinburgh in October 1856 to his new home at 11 Rutland Street, feeling he had derived great benefit from his European trip, and from his intercourse with various learned and distinguished men.

In April 1855, Lister had been elected a Fellow of the Royal College of Surgeons of Edinburgh, and, in October 1856, he was appointed Assistant-Surgeon to the Edinburgh Royal Infirmary. In November 1855, he gave his first winter course of lectures on surgery, supplementing them in the summer with a voluntary course. Both were a success, his students being impressed by the depth of thought manifested by his instruction and by the knowledge they gained of surgery and surgical pathology. In December 1856, Lister gave his first public lecture before the Royal Society of Edinburgh on 'The Minute Structure of Involuntary Muscular Fibre.'

This period of his residence in Edinburgh was further

Joseph, Baron Lister

marked by far the most important of his early investigations, viz., "On the Early Stages of Inflammation," for he never lost sight of the dominant object of his life, first awakened in him by his London hospital experience, which was the removal of the sad mortality in hospitals following operations and injuries. These fatal hospital diseases, he considered, were the offspring of inflammation, and his scientific work was largely directed to the study of this process. He was convinced that these wound complications were the result of the decomposition of the blood in wounds, and, if the cause of the decomposition could be ascertained, it would then be overcome. This resolve was strengthened by the conditions that prevailed in the Edinburgh Infirmary, as indeed in all hospitals in the kingdom, for Mr Syme's wards, though not specially affected, had their quota of erysipelas, pyæmia, and hospital gangrene. This state of matters was further brought into prominence by the introduction of chloroform as an anæsthetic by Sir James Young Simpson, one of our trio of illustrious medical men of the nineteenth century.

With the employment of anæsthetics, a marked increase in the number of operations occurred, and hospital mortality was consequently heightened. So serious a menace had it become that Sir James Young Simpson drew attention to it in a special paper on "Hospitalism," and in it he thus put the very grave position of matters: "In hospitalising men, we decrease their health-rate and increase their death-rate, even though the men thus hospitalised are comparatively in a state of good corporeal or physical health." Towards this question of Hospitalism Lister's mind was steadily directed, and all his scientific work was devoted to a study of the minute processes occurring in the initial stages of inflammation, special investigations being directed to the cause of

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coagulation of the blood. It was through these channels, Lister felt sure, that the solution of the problem he sought would be attained.

As time went on, Lister's ability as a surgeon became more and more recognised. He had established his reputation as a lecturer and as a skilful operator, and his high scientific acquirements were acknowledged on all sides. When, in 1859, the Regius Professorship of Surgery in the University of Glasgow became vacant by the death of Dr James Lawrie, it came as no surprise to his Edinburgh friends that he was appointed by the Crown, on 28th January 1860, to the vacant Professorship.

Professor of Surgery in the University of Glasgow

In May 1860, Lister arrived in Glasgow to take up his duties as Professor of Systematic Surgery. He came with a high reputation as a surgeon of great ability, as an expert physiologist and pathologist, and as a scientific worker and thinker. He found the University to which he had been appointed staffed with a brilliant professoriate, and possessing a medical school of high repute. He began his work with a voluntary summer course of lectures, which was well received, and, in the winter, he delivered the usual course of lectures on Systematic Surgery to a class of 182 students, whose confidence and good opinion he soon won, they, in their turn, gratifying and stimulating their teacher by their regular attendance and enthusiasm. The same happy relations between student and teacher continued during the whole period of Lister's occupancy of the Chair of Surgery. For fifteen months he had no hospital work, as there were no wards attached to his Chair, but, in October 1861, he was elected surgeon to the Glasgow Royal Infirmary. It was in this interval that Lister wrote in Holmes' *System of*

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Surgey his articles "On Anæsthetics" and "On Amputation," and continued his studies on "The Coagulation of the Blood," both within and without the blood vessels.

When Lister was appointed Surgeon to the Glasgow Royal Infirmary, the building was partly old and partly new, it having been found necessary to erect an additional surgical block, which was formally opened in May 1861. Lister's wards were situated in the new part. Unfortunately, Glasgow Royal Infirmary, like all other hospitals in the United Kingdom and indeed everywhere, was a hotbed of surgical diseases, these very fatal complications after injuries and operations known as erysipelas, cellulitis, hospital gangrene, pyæmia and septicæmia, being rife.

The wards taken over by Lister, though spacious and lofty, were in the same sorry plight as the rest of the hospital and he was faced by a most disheartening condition of affairs, which, to one of his sympathetic temperament and high ideals of the surgical art, were a constant grief and disappointment. He did not, however, despair. On the contrary, he was stimulated to remedy this state of matters and to attain what he had made the main object of his life, the mastery of these diseases. To this problem he devoted his laboratory researches; and in the details of his everyday surgical work, and in the management of his wards, he sought the cause and the cure of these evils which marred all surgical work. He felt certain on two points; the suppuration in the wounds induced the complications, and the exciting cause of suppuration came from without. In proof of this latter theory was the striking fact daily before his eyes, as well as before those of other surgeons, that none of the sequelæ so dreaded in surgery made their appearance if the injury did not involve the skin.

It is on record that on one occasion in the wards, when

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demonstrating a severe arm injury with unbroken skin, he said to his students: "Gentlemen, it is a common observation that when severe injuries are received without the skin being broken, the patients usually recover, and do so without any severe illness. On the other hand, trouble—often of the gravest kind—is always apt to follow, even in trivial injuries, when a wound of the skin is present. How is this? I cannot help thinking that the man who is able to explain this problem will be the one who will gain for himself undying fame." The only explanation Lister had to fall back on was a chemical one, which was in accordance with the prevailing knowledge of the day. It was that putrefaction in the wounds was caused by the oxygen of the air. To Lister, this was not acceptable, as he tells us in his Huxley lecture of 1900, when he says: "I freely used antiseptic washes, and I had on the tables of my wards piles of clean towels to be used for drying my hands and those of my assistants after washing them, as I insisted should invariably be done in passing from one dressing to another. But all my efforts proved abortive, as I could hardly wonder when I believed, with chemists generally, that putrefaction was caused by the oxygen of the air." By 1865, however, circumstances had occurred which led Lister to take a new view of the cause of wound putrefaction. This new view was the outcome of work done by Louis Pasteur, the third of our trio of illustrious men of the nineteenth century.

It has been said by the late Dr Guthrie in one of his eloquent sermons that if one revisits an old battlefield, although Nature, with kindly hand has clothed the spot with verdure and with flowers, it is easy to recognise the key of the position, for, where the graves of the dead lie thickest, there the conflict was the fiercest and there the

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tide of battle ebbed and flowed. The same holds good in the intellectual world, and, if we find any subject or subjects that have been the centre of prolonged controversy and around which there are grouped diverse contributions from the best minds of the period, one may rest assured that there have been involved principles of vital importance and essential to real progress.

Applying this test to the middle of last century, we find that the two subjects, "Fermentation" and "Spontaneous Generation," were warmly debated at that time, and that scientific opinion was sharply divided. Their solution was furnished by Louis Pasteur, who has always been regarded as "the link between the scientist and the medical man, between the laboratory and the factory." Armed with the two weapons which he always employed, the microscope and experiment, Pasteur demonstrated conclusively that fermentation was due to minute organisms and living plants, in short, that it was a vital phenomenon and not a chemical one. In a similar way, he dealt with the origin of life and proved there was no such thing as "Spontaneous Generation," but that all material, if deprived of life by sterilisation, remained sterile for all time, unless air loaded with micro-organisms got access to it, when at once it began to swarm with life. In 1864, Pasteur furnished to the French Academy of Sciences his final and unanswerable evidence that "Spontaneous Generation" never occurs.

The outcome of these innumerable experiments and observations of Pasteur was the foundation of the "Germ Theory," and was a revelation to the scientific world of a new view of our everyday surroundings, making it clear that we live beset on every side with countless hordes of minute organisms, some of them friendly and useful, others actively

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hostile to our existence, and that, as regards their habitat, they seem to be practically everywhere.

This was the beginning of a "new learning" which Pasteur was not slow to grasp. Neither was Lister, for when, in 1865, he became acquainted with this great advance in scientific knowledge, having long given the matter his thought and study, he came to the conclusion that these microbes or germs were the active factors in the putrefaction of wounds, causing in them inflammation, suppuration, erysipelas, hospital gangrene and pyæmia—in fact, all the fatal sequelæ that were so apt to follow operations and injuries. If this were so, the proper basis of all wound treatment should be, first, the destruction of microbes that had already obtained access to the wound, and, secondly, their subsequent exclusion during healing. Upon these lines he decided to work, choosing as his germicide Carbolic Acid, having heard, in 1864, of its remarkable effects upon the sewage of Carlisle, small quantities of it having proved a complete deodorant, and having power to destroy the entozoa which usually infest cattle fed upon sewage pastures.

Choosing "compound" or "open" fractures, as the class of cases on which to commence his investigations, Lister, in March 1865, treated his first case. It was unsuccessful, but his next one in August of that year did well. Encouraged and strengthened in his efforts, he continued to work on the same "Germ Hypothesis," improving and modifying his technique from time to time, and, in 1867, he was able to publish in *The Lancet* eleven cases of compound fracture treated successfully by his new method, based on the "Germ Theory" of Pasteur.

These were Lister's first cases, but they were the prelude to further successes which showed in a most striking and conclusive way the correctness of the principle he had laid

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down, and which marked a complete revolution in surgical work. Its influence for good in the condition of his wards was so striking that at the Dublin Meeting of the British Medical Association in August 1867, he was able to make the following statement: "The two large wards in which most of my cases of accident and of operation are treated were amongst the unhealthiest in the whole surgical division of the Glasgow Royal Infirmary. Since the Antiseptic System has been brought into full operation, and wounds and abscesses no longer poison the atmosphere with putrid exhalations, my wards, though in other respects under precisely the same circumstances as before, have completely changed their character, so that during the past nine months not a single instance of pyæmia, hospital gangrene or erysipelas has occurred."

During his two remaining years in Glasgow, Lister, absolutely assured of the soundness of the views he had adopted, devoted his attention largely to perfecting his technique, so that we find the original dressings of carbolised lint, block tin, and carbolised paste (putty) abandoned, and a "lac plaster" introduced. Another improvement aimed at was a better ligature to replace the silk ones in use, attention being chiefly directed to catgut as a material. Hostile criticism of this new system was not wanting on the part of his surgical colleagues and a good deal of Lister's time was occupied in dealing with incorrect and misleading articles on his results, so that with hospital work, private work and University teaching his life was a very busy one. It may have been an acceptable change to him when he was appointed in August 1869 to the Chair of Clinical Surgery in Edinburgh to succeed Mr Syme, who had resigned for reasons of health; but he left Glasgow with many regrets.



9 CHARLOTTE SQUARE, EDINBURGH (second from left).

The house occupied by Professor Lister during his tenure of the Chair of Clinical Surgery.

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Professor of Clinical Surgery, University of Edinburgh

Returning to Edinburgh, Lister found himself amongst old friends and warmly welcomed by his fellow-professors at the University. His surgical colleagues at the Hospital, however, were, in the main, sceptical as to the Germ Theory and the merits of the new Antiseptic System, and, as a consequence, their attitude towards him was not so friendly and cordial on this subject as he would have liked. Recently, too, there had been an unfortunate incident known as "The Lawrie Episode" which had led to a good deal of feeling. It arose as follows: Lister had been experimenting with catgut ligatures and, having formed a good opinion of them, had sent some from Glasgow to Mr Syme. Syme's house-surgeon in the summer of 1869 was Edward Lawrie. Mr Spence had arranged to tie the right common carotid artery in a man, and had applied to Lawrie for some carbolised catgut, which was given to him. The operation was unsuccessful and the patient died in two days, comatose and paralysed on the left side. At the post-mortem examination it was found that there was no sign of constriction at the place where the ligature—not the knot—had given way and had become so gelatinous and puffy that it seemed as if it had been cast in gelatine. Mr Spence reported the case in *The Lancet* and Lawrie wrote a letter in reply, couched in terms that led Mr Spence to complain to the Infirmary Managers, who summarily dismissed Lawrie. The whole incident, as I said, created a good deal of feeling. One day, when looking over Syme's operation book, I read the following entry: *Patient's name*—Edward Lawrie; *Admitted*—April 1869; *Dismissed*—July 1869; *Disease*—Honesty; *Operation*—Martyrdom; *Result*—In statu quo."

Edinburgh has always had its supply of *odium medicum*, and acrimony has often marked its disputes, from the days

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when Dr Gregory of Powder fame was fined 100 guineas for maltreating, with his gold-headed cane, a medical opponent who differed from him in a controversy ; or, in more recent years, when a surgeon afterwards celebrated in London waited outside the Edinburgh Infirmary, horsewhip in hand, to castigate Liston for having spoken disrespectfully of him. Though warmly and sharply discussed, the Germ Theory was free of any extreme accompaniments such as these, and was entirely controversial, ranging from the pompous authoritative opinion of one professor who considered he had settled the whole question when he announced that Lister's work would be found "unreliable, being based on the fatal bias of a fixed theoretical preconception," to the gentle sarcasm of the College Lays with its amusing ditties, "There's nae Germs about the Hoose," and "Germs, busy Germs."

The three features that marked the clinical work of the eight years of his Edinburgh professorship were, first, the improvement in the technique of his Antiseptic System, by making it as simple as possible while meeting the demands of his theory ; secondly, the extension of the scope of operative surgery, because being absolutely assured of the soundness of the principle upon which his work was based, he felt that there was an enlarged field of operations ; and, thirdly, that by successful results in this extended scope of operations he would be in a better position to convince the profession of the correctness and advantages of his teaching. The two important changes in technique were the introduction, in 1870, of absorbent dressings of carbolised gauze, and the use of a carbolic spray at operations and when changing the dressings. As instances of extended operative measures may be mentioned those for deformities of bones, wiring of un-united and badly-united fractures, and suprapubic lithotomy. There were also

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initiated wider operations for cancer of the breast ; diseased joints were freely opened, and radical treatment of hernia by the open method was introduced.

All these new departures were attended by success. Lister was able not only to quote them, but to show the Profession that the mortality of surgical operations had been greatly reduced, as also the number of amputations, and that he had completely abolished in his wards the dangers of wound complications, such as erysipelas, pyæmia, hospital gangrene, etc. There was still, however, great professional opposition, and he had to battle with the indifference of colleagues, who did not wish to be convinced. There was even published much hostile criticism, which cost Lister a good deal of personal annoyance, for it was based upon the assertion that he had introduced a system already known and practised on the Continent and had claimed the discovery of the Germ Theory and of carbolic acid. This he had never done, having always acknowledged his indebtedness to Pasteur.

During those early years in Edinburgh, I worked under Lister and saw the many important changes he made in his technique. It was during my house-surgeoncy in 1873 that the well-known poet and essayist, William Ernest Henley, came under his care, and, in his case, Lister took the deepest interest. Henley had already lost one foot from tuberculous disease ; the other was affected, and its removal had been recommended. Lister operated upon him successfully, and I always felt how thankful we should be that he survived the operation, for in *A Book of Verses* Henley gave us one of the most correct and life-like descriptions of the greatest surgeon of all time.

Lister had every reason to be satisfied with his efforts while in Edinburgh. His classes were well attended by

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earnest and attentive students, and he had abundant proof of the spread of his system when, in the summer of 1875, he made a tour in Germany. The German surgeons had shown more interest in his work than those of any other country, and he received a most enthusiastic reception. In the words of *The Lancet*: "The progress of Professor Lister has assumed the character of a triumphal march." This was not to be wondered at, for abroad it was felt that he was their benefactor. A second instance of the hold that anti-septic surgery was taking on the Profession was furnished at the Meeting of the British Medical Association in Edinburgh in 1875, when his demonstrations of his method of operating and of dressing wounds created a deep impression. Again, in 1876, when he took part in the International Medical Congress at Philadelphia, he received a most cordial and hearty welcome, and was made President of the Surgical Section. By this visit American surgeons were greatly impressed, and there is no doubt that it stimulated them to believe in and practise his doctrine. The year 1877 was destined, however, to see the termination of his work in Edinburgh, when he was appointed Professor of Clinical Surgery at King's College, London, vacant by the death of Sir William Fergusson.

Professor of Clinical Surgery, King's College.

Lister's decision to return to surgical work in London was undoubtedly influenced by his desire to carry the campaign of the Antiseptic System into the stronghold of opposition; for London was still recalcitrant, although the North, the South, and the East of the United Kingdom, as well as continental countries, like Denmark and France, had recognised the truth of his teaching and had adopted his methods. His Introductory Lecture at King's College

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was on "The Nature of Fermentation." At first he met with no encouragement, and experienced much disappointment, his class being represented by a few straggling students, while his wards for a long time had many empty beds and few patients were admitted.

Opposition, too, existed outside amongst the London surgeons; a leading surgeon, Mr Savory, in his address on Surgery at the British Medical Association in London in 1879, criticised Lister's theories and practice, threw discredit upon his work, and stated his belief that results as good as Lister's could be obtained by ordinary methods. This did not discourage Lister. He was soon able to write that things were greatly altered for the better, and that his clinical class numbered 73 students, all of them interested in the operations and sitting out his lectures to the end. This meant a great deal, for students had hesitated to join his classes, being aware that his teaching was not acceptable to the examiners before whom they had to appear.

Although London was not enthusiastic about him, Lister found great encouragement from other sources, and notably so at the International Medical Congress at Amsterdam in 1879, when, as the *British Medical Journal* reported, "he was received with an enthusiasm which knew no bounds"; the deafening and repeated cheers continued until Professor Donders taking him by the hand said: "Professor Lister, it is not only our admiration which we offer you; it is our gratitude and that of the nations to which we belong." Lister, undaunted, continued his work at King's College Hospital, and successfully performed more and more difficult operations, all of which could be seen by those interested and desirous of instruction. These became very widely known and talked about, until the Profession realised that there

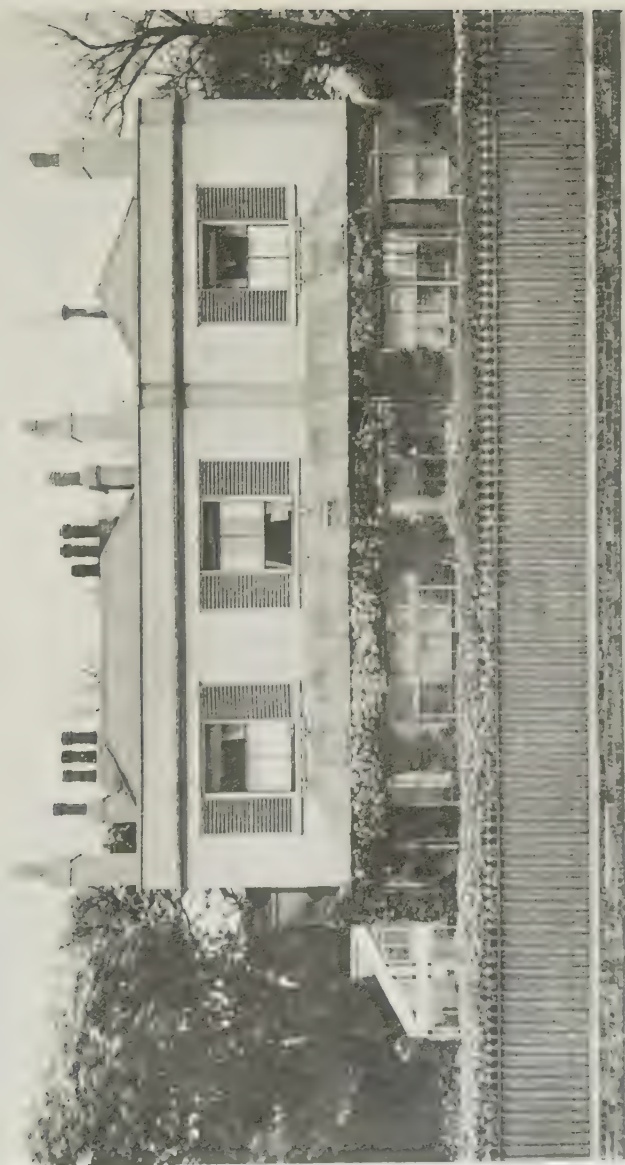
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must be something in the Antiseptic System ; and personal contact with Lister revealed to his visitors an unassuming, courteous gentleman, animated by a firm belief in the principles he taught and carried out, which were at the command of any who cared to adopt them. Success came slowly and steadily, and ere long Lister was regarded as the leading surgeon of the day.

In 1880, Oxford and Cambridge conferred on him their honorary doctorates, and, in 1883, he was made a Baronet. In 1892, he retired from King's College on the age limit of 65, continuing, however, in charge of the wards for another year at the request of the Hospital authorities. In 1893, a heavy affliction overtook him in the death of his wife, whose affection and practical interest in all his work was the mainspring of his life, so that when she died from pneumonia after a short illness while they were on holiday in Italy, Lister was left a lone and broken-hearted man.

In Retirement

For a short time after leaving King's College, he kept up his interest in surgery, but in 1896 definitely gave up private practice. Retiral from work as a surgeon by no means left him unoccupied. From 1895 to 1900 he was President of the Royal Society, and in 1896 he was President of the British Association. About this time he took an active part in the reorganising of the Jenner Institute of Preventive Medicine, which was afterwards to be known as the Lister Institute. In 1897, he visited Canada when the British Association met in Toronto, and, in 1900, he delivered the third Huxley lecture. This was the last of his great public addresses, but, in 1901, he took the Chair at the second Tuberculosis Congress in London, when Koch made his startling



PARK HOUSE, VALMER, KENT.

Occupied by Lord Lister from 1908-1912, and in which he died on the 10th February 1912.

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announcement that human and bovine tuberculosis were separate and distinct diseases.

In his later years, Lister was the recipient of many honours, both at home and abroad, and all the Universities and learned Societies were desirous to show him honour. He was raised to the Peerage in 1897, and in 1902 he became an original member of the new Order of Merit founded by the late King Edward VII. In 1898 Edinburgh conferred on him the Freedom of the City, in company with Lord Wolseley, as did London (1907) and Glasgow later on (1908). On the occasion of his 80th birthday, 5th April 1907, he was the recipient of congratulations and felicitations innumerable from all parts of the world.

Until 1903, Lister's health was for one of his years fairly good, allowing him to take part in the work of societies and other public institutions, but in that year, when he was seventy-six years of age, he had a serious illness at Buxton, which made him an invalid for the rest of his life, having crippled him and rendered him unable to take active exercise. The remaining nine years of his life were spent in retirement, partly in London and partly in the country; but, in 1908, he went to the quiet seaside town of Walmer in Kent, where, with sight and hearing impaired, his once powerful muscular frame gradually weakened, and on the morning of 10th February 1912 he passed peacefully away in his 85th year, to the regret of the whole world. He had an impressive funeral in Westminster Abbey, in which is placed a tablet to his memory; according to his own request, his remains were laid to rest in West Hampstead Cemetery, beside those of his wife, and a plain tombstone marks the spot where they now lie side by side.

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Lister's Personality

A biographical notice such as the above would be wanting in completeness if nothing was said of his personality. As I remember him in the early seventies of last century, one was at once struck by his powerful physique and activity, as well as by his handsome face, with its bright attractive eyes and clear pink and white complexion. His manner was gentle and unassuming, making a dignified and charming personality to which one was instinctively drawn. He was always courteous and kind to those around him and markedly so to his patients, a trait characteristic of the religious body from which he sprang.

As a lecturer, he was clear and lucid, with an occasional slight hesitancy in his speech, his voice being soft and musical. He operated with dexterity and care, never aiming at rapidity or brilliancy. In his work, he was thorough, enthusiastic, and resourceful, ready for any emergency, and skilful in meeting it. Of indomitable courage, he was never disheartened by difficulties or opposition, overcoming all obstacles by steady determination and perseverance. His motto was that of the British soldier—"Fight on." His leading principles were love of truth, freedom from jealousy and a readiness to acknowledge his indebtedness to others.

In those under him he developed enthusiasm and interest in their work, winning their admiration by his high ideals, and attracting them by his quiet, gentle manner. Well might there be applied to him Shakespeare's lines:

"His life was gentle, and the elements
So mixed in him that Nature might stand up
And say to all the world—'This was a man.'"

In his modest nature no love of display found a place,

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and he never courted popularity. His sentiments were rather those of the late Charles Dickens :

“ Not myself, but the truth that in life I have spoken,
Not myself, but the seed that in life I have sown,
Shall pass on to ages—all about me forgotten,
Save the truth I have spoken, the things I have done.”

The British Medical Association has decided well to celebrate at their Meeting the Centenary of his birth, and in the City where a great part of his life was spent, to honour his memory and to remind all attending the gathering of the debt the world owes him.

Lister can never pass out of the world's memory. Though dead, he still goes on healing. He is one of our Immortals, and, in years to come, the generations yet unborn will regard him as one of the greatest benefactors of mankind and will recognise the justice of the simile that has likened him to Aaron of old, who stood in the day of pestilence between the dead and the living, for by Lister, and Lister alone, the Plague of Surgical Sepsis was stayed. Of this it is well to be reminded from time to time—

“LEST WE FORGET.”

GEORGE THOS. BEATSON.

II

BEFORE THE DAWN

I

IT was in 1853 that Joseph Lister came to Edinburgh. He had by that time become a Fellow of the Royal College of Surgeons of England, and had served for nine months as House Surgeon under Erichsen at University College Hospital. His decision to devote himself to Surgery had been made, and his immediate intention was to spend a few weeks following the practice of James Syme, then at the height of his fame, and thence to proceed on a tour of the continental hospitals before settling down as a consulting surgeon in London.

The two men were at once strongly attracted to one another, and Lister gladly accepted Syme's offer of his house-surgeoncy in the Royal Infirmary. Soon he became Syme's private assistant and was intimately associated with him in all his work. It is possible that Edinburgh contained another attraction for Lister; in any case, within two years he became engaged to Syme's eldest daughter, Agnes, and in 1856 they were married. For nearly a quarter of a century Lister remained in Scotland, and save for the momentous nine years during which he filled the Regius Chair of Surgery in the University of Glasgow (1860-1869), he was closely associated with the Edinburgh School, first as an Extra-Mural Lecturer and later as Regius Professor of Clinical Surgery.

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When he returned to London in 1877, his object was no longer to build up a consultant's practice, but was avowedly to carry his message direct to the Metropolis, which had hitherto been slow to accept it.

II

In the meantime, the whole outlook of surgery had been changed. It is a commonplace to say that the work of Lister revolutionised the practice of surgery, and that his name is the greatest in the history of Medicine. These dicta are accepted without challenge; often perhaps without due consideration of what they really imply.

Only those who from experience are familiar with the conditions under which surgeons carried on their work in the 'fifties and 'sixties of last century can fully realise the significance and the extent of the revolution; but now they are few. There are still with us some who lived through the epoch when the antiseptic idea was germinating and coming into flower, and who have seen the fruit gathered. Some of them were Lister's personal disciples and have told us the story: Watson Cheyne, Hector Cameron, John Stewart, and, when this was first written, Francis M. Caird—but him we have lost. From what they have told us we can form some idea of the difficulty of the problem that Lister set himself to solve, of the obstacles he had to overcome, some of them inherent, others extraneous, and of the unflagging faith and courage with which he faced his task.

Those of us who were born too late to share in the making of the antiseptic era, and have merely enjoyed the fruits of it, can only realise our good fortune if we try to reconstruct the conditions under which surgeons had to work in the years before Lister began his great crusade.

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III

In attempting to reconstruct the surgical period just before the dawn of the Listerian era, we must avoid the common preconception that it was wholly dark and unilluminated. In the twenty years that preceded the advent of Lister in Edinburgh, surgery had shared with the other branches of medicine in the revival that marked the middle decades of last century, but, while Medicine was advancing as a science, Surgery was making progress chiefly as a craft.

The surgeons of this period are the great names in surgical history and they had brought their art to a high degree of proficiency. In France, the influence of Larrey, Dupuytren and Delpech was still active, and Lisfranc, Velpeau, Malgaigne and Nélaton were still at work. Germany had Langenbeck, Diffenbach, Von Graefe, and Stromeyer. Pirogoff, the most important figure in the medical history of Russia, was at the height of his fame. America could boast of Valentine Mott, James Marion Sims, and Thomas Addis Emmett. The London School was represented by Astley-Cooper, Travers, Wardrop and Benjamin Brodie; and Dublin by Abraham Colles. In Edinburgh we had Robert Liston, John Lizars, William Fergusson, and, greatest of all, James Syme.

There was, therefore, no lack of accomplished men ready to meet the call that was made on the surgeons of these days. They were all imbued with the spirit that led the Barber-Surgeons of Edinburgh in 1505, to include in their Seal of Cause the stipulation "That everie man that is to be maid frieman and maister amangis us . . . knaw anotamea nature and complexioun of every member In manis bodie . . . for every man aucht to knaw the nature and substance of every thing thatt he wirkis or ellis he is negligent." In modern

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English, "he must know his anatomy," and most of the surgeons of this period spent a long and arduous apprenticeship in the dissecting-room as teachers of that subject.

But an intimate knowledge of the material on which they worked was not enough. To be "cheirurgeons" they had to possess a high degree of manipulative skill and manual dexterity, and, in the days before the use of ether or of chloroform had abolished the element of pain from an operation, they had to carry out their work rapidly. To these ends they assiduously trained themselves in the use of their hands. To gain digital agility some practised the violin; some fashioned their own instruments, carving appropriate designs on the ivory handles; and others made exquisite anatomical dissections many of which are still extant and bear witness to their skill.

To this delicacy of manipulation they added speed, which was sometimes cultivated to such an extent that operations tended to become spectacular. The reputation of a surgeon was often based upon the rapidity with which he could amputate a limb or remove a stone from the bladder, and a stop-watch was an indispensable item in the theatre equipment. In different schools strange legends survive of the rapidity with which operations could be performed. It is said that an admiring pupil of Fergusson's, when he took a friend from another hospital to see his master perform lithotomy, warned him "not to wink or he might miss the operation altogether." Another surgeon took off an arm at the shoulder while a colleague had turned aside to take a pinch of snuff. Liston could amputate the thigh single-handed, compressing the artery with his left hand while he used the knife and the saw with his right, and he did it in as few seconds as a first-class sprinter takes to run a hundred yards. He himself said that "there could be no apology

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for the operation of lithotomy occupying two or three minutes at most."

Of Pirogoff it is said that "in speed, dexterity and strength of hand, he was like those Slavonic virtuosi of music whose execution is the astonishment of our times." The limits of "brilliance" in operating were exceeded, however, by the surgeon who, with one sweep of his knife, cut off a limb, as well as three fingers of his assistant and the coat-tails of a spectator.

Even if we discount some of these traditions, it must be admitted that, within the limits set them, the surgeons of this period have never been surpassed as skilled craftsmen.

IV

But fully equipped as they were as anatomists and as operators, for the technical exercise of their craft, their usefulness was restricted by their limited knowledge of the essential nature of many of the conditions with which they were called upon to deal.

It is true that in Edinburgh a Chair of Pathology had been founded as early as 1831, but for many years it was morbid anatomy rather than pathology, in the modern sense of the word, that was studied. The changes that mark the transition from the physiological to the pathological were little considered, and recorded observations chiefly deal with disease in its advanced stages. Inflammation, which had been intensively studied, and on which Hughes Bennett wrote a series of masterly essays, was still looked upon as a disease rather than a process: James Y. Simpson's graduation thesis was on "Death from Inflammation." Even in exhaustive communications, characterised as they are by remarkable clarity as clinical records and as descriptions of

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operative procedure, the pathological diagnosis often goes no further than "inflammation of the tissues," "disease of the bone," "necrosis of the thigh," "ulceration," "tubercle"; or terms like "congestion," "phlegmon," "strumous," or even "morbid action" have to suffice.

It was not until Virchow, in 1858, gave a new conception of the conflict of cells which constitutes disease, that pathological terms began to be positive and determinate. With the clearer thinking that followed the permeation of Virchow's doctrine of cellular pathology, came a better understanding of diseased processes, which led to greater discrimination in the selection of cases for operation, and a general improvement in surgical practice. But with it all, there was something wanting.

V

In the pre-Listerian period the range of surgery was much restricted in comparison with what it is to-day, and many of the operations that then exercised the thoughts and the ingenuity of surgeons have now little more than an academic or even an historical interest. The "major" operations of the period were ligation of large arterial trunks for aneurysm, the removal of tumours of the jaws and of the tongue, amputations, and "cutting for the stone."

No operations called for more courage, more skill and more resource than the operations for aneurysm. The most satiated operator of to-day cannot but be thrilled as he reads the records of some of these classic operations—operations that he has probably never been called upon to undertake.

From the spectacular point of view, the operation of perineal lithotomy was the touchstone by which a surgeon's dexterity was assessed. It was also a fruitful source of

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controversy, and every detail of the procedure was hotly, even acrimoniously, discussed. The curve or the angle of the staff, the position and extent of its groove; the shape of the knife-blade or the length of its handle; the use of the gorget in place of the knife; and the disposition of the "petticoated" drainage tube were particulars to which a surgeon would attribute his own successes or his opponent's failures.

The allied operation of "perineal section" ran lithotomy very close as a subject of controversy. Papers, pamphlets, and even bound books, were written to set forth opposing views, and the discussion sometimes ended in the Law Courts.

These operations are now almost obsolete, and it is easy for us to smile at the disputes to which they gave rise when we know that the issue did not depend upon how the wound was made, but on what subsequently happened in it. May we not recognise in these controversies of our predecessors the expression of a suppressed uneasiness that there was something at work that constantly thwarted their best efforts—they knew not what.

In those days much attention was devoted to improving the methods of performing amputation, which was so often the only surgical resort in diseases of bones and joints, and in compound fractures. It is not too much to say that many of the procedures introduced by Syme, Teale, Pirogoff and other surgeons of the period have never been improved upon. But excellent as they were from the purely technical point of view, the inflammatory complications in the form of suppuration, thrombosis, erysipelas, or "hospital-gangrene" which had necessitated the removal of the limb, so often attacked the stump that the patient succumbed to secondary hæmorrhage, septicæmia, or pyæmia; and again the efforts of the surgeon were frustrated.

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So uncertain were the results that the operation of amputation came to be regarded by surgeons themselves with a sense of shame, and a school of "conservative surgeons" arose who sought to avoid the "opprobrium of surgery" by adopting measures less drastic than amputation. In place of removing the limb, attempts were made to excise the diseased parts, and so great was the success that attended excision for tuberculosis and other disorganising diseases of joints that the operation became an established surgical procedure. It is true that these operations did not eliminate the risk of sepsis, and they involved a long and often dangerous convalescence, but, if the patient survived, his limb had been conserved, even if it was not always sound and useful.

Some of the most dramatic operations of which we have records were those performed for the removal of extensive growths of the jaws and tongue. The disease was usually far advanced before removal was attempted, and when we remember that the operations were often carried out under the most unfavourable conditions in the humble houses of the poor, the success that attended them is remarkable.

Although the fields of orthopædic and plastic surgery, as we now understand these terms, had not been extensively cultivated, excellent results were obtained in the treatment of congenital deformities like hare-lip and cleft-palate, and in the restoration of the nose and face after destructive diseases or injuries. In the treatment of club-foot and of various contracture deformities in the region of joints, open division of tendons was being employed, but the frequent occurrence of sepsis led to the substitution of subcutaneous tenotomy—a straw that showed how the wind was blowing.

Surgeons were beginning to operate for the cure of hernia, but the fear of inflammation in the wound spreading to the

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peritoneal cavity prevented the operation becoming popular, and, in the period we are considering, this common condition was usually treated by trusses and other mechanical means.

These operations, which chiefly dealt with the limbs and readily accessible parts of the body, by no means exhausted the scope of the surgeon's efforts, but, along with the treatment of injuries and minor ailments they provided the main part of his work.

The great serous cavities were seldom deliberately encroached upon. It is true that ovariectomy had been performed by M'Dowell in America and by Lizars in Edinburgh, but even such an enlightened surgeon as Syme disapproved of it. The kidney had twice been excised by Simon, but, when the second patient died from sepsis following an exploration of the wound with the finger, the operation lost favour. Middledorpf had operated for the closure of gastric fistula. Operations within the cranial cavity were only performed for injury, until Broca localised and then evacuated by operation an abscess in the brain.

Many other examples of sporadic attempts at operations that are now of everyday occurrence might be cited, but enough has been said to show that while the surgeons of those days were eagerly reaching out towards a wider application of their art, and were fully aware of its possibilities, they were held back by the fear of septic complications which they could neither prevent nor counteract.

VI

If skill in the use of the hands, highly developed appliances and methods of operating, intimate familiarity with anatomical details, and a sound working knowledge of morbid anatomy were enough, there seemed nothing wanting to make surgery

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one of the most beneficent branches of the healing art. Yet over all there hung a great dark cloud.

Every operation was an adventure on which surgeon and patient alike embarked with trepidation. No amount of forethought or of devoted attention could ensure a favourable issue. The days that followed an operation were fraught with even greater anxieties than the day of the operation itself, and there was no peace of mind until the period during which inflammatory complications might attack the wound was safely passed. It was possible that the wound might heal by what was called "the first intention" and all would be well, but the surgeon lived in constant dread that inflammation might set in and be followed by suppuration and blood-poisoning that would prove fatal. The terror of it all lay in the fact that the cause of the trouble was unknown, and that the catastrophe could not be averted by foresight or precaution. It availed little to call it "sepsis" if the nature of sepsis could not be discovered and the process could not be prevented.

The despair of surgeons is reflected in what was written in the *Lancet* as late as 1867. The writer speaks of the mortality from compound fractures, amputations and certain other operations as "something frightful." Death from blood-poisoning, he says, is not confined to cases of severe operations "but happens ever and anon after operations in themselves slight. . . . The risk of blood-poisoning is now the one great opprobrium of surgery . . . it is lamentable to think of the extent to which the best and most refined surgery of the time is being frustrated in our great hospitals, and even in those most recently built."

Through the wards of these hospitals there ever stalked the spectre of Sepsis to the accompaniment of the beating of the wings of the Angel of Death.

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VII

It would be wrong to suppose that this state of affairs was passively accepted as inevitable. On the contrary, the acutest minds in medicine were exercised to discover the cause of sepsis and to find a remedy for its effects. It may be admitted that for the most part the search was desultory; many paths were followed, but none seemed to lead far, and they were soon abandoned. An occasional gleam of light came through the clouds, but it only served to make the darkness visible.

In their bewildered groping, surgeons rang the changes on the applications they made to wounds. Lotions, stimulant or sedative; poultices for heat and compresses for cold; oils and salves to sooth, or liniments and sinapisms to irritate and counter-irritate; plasters to compress, leeches to deplete, and how many others, were employed, but while they modified effects they did not remove the cause and so were unavailing to solve the problem of sepsis.

The suggestion of Oliver Wendell Holmes that puerperal fever—a disease analogous to surgical sepsis—was contagious and was directly conveyed from patient to patient, and that it might be prevented by the attendants on women in child-bed washing their hands in calcium chloride solution and changing their clothes before proceeding from an infected patient to one uninfected, contained the germ of a solution, but it was coldly received. It was revived some years later by Semelweis, who by preventing students passing directly from the dissecting-room to the lying-in room, and insisting on the use of calcium chloride for washing the hands, greatly reduced the mortality from this disease in his wards. But such was the conservatism of medical opinion that this demonstrable proposition was so violently

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opposed that Semelweiss was driven into insanity and an early grave.

The impression that the trouble was in some way due to a "contagious effluvium" persisted however, and, on the assumption that the noxious agency was in the atmosphere, attempts were made to exclude air from wounds by mechanical means. Chassaignac, for example, heaped, layer upon layer, on recent wounds strips of diachylon plaster, linen covered with cerate, compresses of charpie, and bandages, but all he could claim was that the "traumatic pain and fever were greatly diminished." As far back as 1842, William Rhind, a surgeon in Edinburgh, accidentally discovered that a coating of gum arabic hastened the healing of superficial burns, which he attributed to its "effectively excluding the external air." Further experiments confirmed this view, and led him to add the stipulation that "rancid gum solution should not be used." But the true significance of these observations was missed.

A further development of this idea was manifested by the introduction of "subcutaneous operations." The disasters that so often followed the free opening of large joints, led surgeons to withdraw serous, sanguineous, or even purulent collections through long, narrow puncture-wounds rather than by open incision, and the satisfactory results of this method of evacuating joints, led to the principle being applied in other directions. For the extraction of a loose body from the knee, for example, an ingenious Frenchman made a valvular opening into the joint, expressed the body into the surrounding connective tissue, and removed it by incision after the wound in the capsule had had time to heal.

The most widely adopted application of subcutaneous operating as a means of excluding air, was for the division of tendons in the rectification of congenital deformities like

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club-foot, and of contractures about joints ; and subcutaneous tenotomy quickly became established as a valuable auxiliary of orthopædic surgery.

VIII

It was gradually becoming evident that septic diseases were more prone to become epidemic in some hospitals than in others, and even that certain wards were especially dangerous. It is said that women begged in tears not to be taken to a particular ward in Semelweiss' hospital. It was also acknowledged that patients operated upon in their own homes ran considerably less risk than those treated in hospital. No satisfactory explanation of these facts was forthcoming, although overcrowding and want of ordinary cleanliness were recognised to be contributing factors. The result was that hospitals, as such, fell under suspicion, and the term "hospitalism" was coined to signify the morbid conditions arising from the gathering of diseased persons in a hospital. James Y. Simpson stated in an important contribution he made to the much discussed subject of *Hospitalism* that "a man laid on the operating-table in one of our surgical hospitals is exposed to more chances of death than the English soldier on the field of Waterloo"; and Cadge, of Norwich, said "although a hospital may not be the mother of pyæmia, it is its nurse." So profoundly was public opinion influenced by the statistical evidence adduced by Erichsen, Simpson, and others, that several old hospitals were demolished and new ones put up in their place. But the matter went deeper than mere statistics could reach, and the familiar diseases, erysipelas, septicæmia, pyæmia and hospital gangrene, broke out afresh, and the new barns that had been built were no better than the old ones that had been pulled down.

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Lister's own experience in what was then "the New Surgical Hospital" in Glasgow was such, he says, "as to make me sometimes feel it a questionable privilege to be connected with the institution." Yet it was in these surroundings that he found the solution of the problem.

IX.

At last the cloud of doubt and despondency that had hung over surgery for so long began to break up, and shafts of light filtered through. The idea that septic inflammation was due to some particulate infection had long been simmering in Lister's mind. As early as 1854, the year after he came to Edinburgh, John Batty Tuke tells us, that at the dressing of a wound that had healed by the first intention, except where the ligature was, Lister remarked, "But why is it not healed round the ligature?" Tuke suggested "The irritation of the ligature." "No," replied Lister, "not of, but *in* or *on*"; and he made the further remark, "The main object of my life is to find out how to procure this result in all wounds."

Towards this object his own investigations on the structure of muscle, on the arrangement and functions of the vasomotor nerves, on the phenomena of inflammation and on the coagulation of the blood were co-ordinated, and they threw a flood of light on the problem, without, however, supplying the key.

It is interesting in passing to recall that Lord Lister's father, Joseph Jackson Lister, while still a boy, had observed that a natural defect in his vision was improved by looking through the air-bubbles in the window-pane of his nursery. Later in life he took up the study of optics as his hobby, and he eventually "gained a world-wide reputation for his

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discoveries" in that field of Science. He made the necessary mathematical calculations, and actually ground the lenses with which the manufacturers produced the modern compound microscope, the instrument which alone made his son's investigations possible.

Another ray of light was supplied by Tyndall, who in his researches on spontaneous generation found that the air of the high Alps was dust-free, and that tubes of putrescible fluid could be exposed for indefinite periods without putrefaction occurring.

Then came the momentous discovery of Pasteur that the process of fermentation was due to micro-organisms.

It was left to the genius of Lister to give these apparently disconnected observations their proper collocation. And this was his life work. If ever that "transcendent capacity for taking trouble," which Carlyle says means genius, was manifested, it was by Lister. He pursued the object of his life as the Hound of Heaven pursues the sinner :

. . . with unhurrying chase,
And unperturbèd pace,
Deliberate speed, majestic instancy.

and in the end he gained his victory and he had his reward, which with native modesty he tells us was "the hope that I may have been the means of reducing in some degree the sum of human misery."

This he did : and more. How much more, others will tell.

ALEXANDER MILES.

III

LISTER AS PHYSIOLOGIST

The Influence of his Teachers

JOSEPH LISTER came early into contact with four scientific men of outstanding eminence, viz., Joseph Jackson Lister, Thomas Graham, Wharton Jones and William Sharpey. All of them had considerable influence upon his career, and a brief account of each will not be without interest as a prelude to this chapter.

Joseph Jackson Lister, his father, himself a Fellow of the Royal Society, although actively occupied with business, nevertheless found time to interest himself in microscopic work and especially in the construction of microscopic lenses. With this object he contrived to give himself a good training in mathematics, which, as his son remarks, "he turned to excellent account in his endeavours for the improvement of the microscope." He was the first to produce those combinations of achromatic lenses into one objective, which form the basis of the construction of the modern microscope. As long as he lived, he and his son were in close touch with one another, either personally or by letter, and there can be little doubt that the manner in which Joseph Lister constantly resorted to the microscope to aid him in resolving the problems in physiology and pathology with which he was concerned, was the result of the interest in microscopy early inspired by his father.

There has been a tendency of late years in certain schools of physiology to neglect the lessons taught by the microscope

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and to leave that instrument entirely to anatomists. But with the anatomist its uses are restricted, and since it is necessary to know what changes occur in the elements of an organ when it exhibits activity, the microscope is indispensable to the prosecution of researches in physiology and pathology. The history of the investigations which eventually led Lister to the formulation of the germ theory is an illustration of this, for in all these researches he was constantly referring to the available microscopical evidence.

Thomas Graham, the distinguished chemist, was amongst Lister's first teachers, when he began the study of medicine. Graham is best known for his investigation of the colloid condition of matter, a subject which occupies a preponderating position in the present-day study of physiological problems. He was a man of wide and philosophic views, and Lister did not fail to profit by his example.

Wharton Jones was another of his teachers, by whose work Lister was much attracted. For many years Professor of Ophthalmic Medicine and Surgery in University College, Wharton Jones is probably now better known for his physiological studies, chief amongst these being the phenomena of the circulation in the frog's web and in the bat's wing (in which he was the first to describe the rhythmic contraction of the veins) and the circulatory changes accompanying inflammation. He was also the first person to describe the amœboid movements of the white blood-corpuscles. There was a good deal in common between these subjects and those upon which Lister afterwards worked, and they are similarly characterised by involving accurate observation with the microscope.

William Sharpey, Professor of Physiology in University College from 1836 to 1874, was beyond doubt the man who exercised most influence over the young student. At

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the time Lister began his medical studies, Sharpey was in the full vigour of his teaching career, and Lister himself states that "as a student at University College I was greatly attracted by Dr Sharpey's lectures, which inspired me with a love of physiology that has never left me"; and after speaking of having been equipped by his father with a first-rate achromatic microscope, he adds: "I employed it with keen interest in verifying the details of histology brought before us by our great master. When I afterwards became house-surgeon to Mr Erichsen, I applied the same means of observation to pathological work."

Researches in Physiology

Lister's first research was histological, but it had a distinct physiological bearing. Performed whilst he was resident in University College Hospital, it already exhibits the thoroughness and accuracy which he brought to every investigation. This research, published in the *Quarterly Journal of Microscopical Science* for 1853, was on the Muscular Tissue of the Iris, the structure and arrangement of which he worked out both in animals and in man. He showed that not only the sphincter but also the dilatator pupillæ is composed of the plain muscular fibre-cells which Kölliker had, not long before, discovered to be the formative elements of plain muscle. He is quite clear as to the existence of a dilatator muscle, although, long after, doubts were cast upon the presence of this muscle by physiologists who were inexpert at histology, and who thought that, if the changes in the pupil could be explained without its existence, a dilatator muscle must be absent.

Lister's second piece of work was also of a histological character, and was published in the same Journal. It dealt

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with the Small Muscles of the Hairs, which had been discovered by Kölliker. Lister shows very exactly the attachments of these small muscles to the skin and hair follicles respectively, and their relation to the sebaceous glands, as well as their constitution of plain muscle; whereas, as he also notices, the arrectores of the large tactile hairs of animals are composed of striated muscle.

Lister's third published work was also upon Involuntary Muscular Fibre. It was instituted to decide the question whether Kölliker's account of the structure of that variety of muscle, which had been called in question by Ellis, was or was not correct. The evidence he brings forward in support of Kölliker's description is overwhelming. Incidentally he describes the appearance of the cells in extension and in contraction, the longitudinal striations which they exhibit, and the manner in which, in small arteries, they are individually coiled spirally round the vessel. This work was performed in 1856, after he had removed to Edinburgh to work under Syme, and is published in the *Transactions of the Royal Society of Edinburgh*, vol. 21, 1857.

In connection with this it is of interest to reproduce the following letter¹ from Professor T. W. Engelmann, written in 1895, when Professor of Physiology at Utrecht.

DEAR PROFESSOR LISTER,—Coming just back from London I have found your kind letter and your most interesting paper on the minute structure of involuntary muscle fibre. I beg you to accept my best thanks for both. I would have been very happy to hear your opinion on different points regarding motion in relation to muscular structure. I am ashamed that I did not know your masterly researches from 1857, when I wrote my paper on the

¹ This letter from *Lord Lister* (by the late Sir Rickman J. Godlee, Bart.) is inserted by kind permission of Lady Godlee and the Clarendon Press.

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fibrillar structure of contractile substances in 1881. But even Kölliker does not mention them in his *Gewebelehre*.

You are evidently the first who observed clearly the longitudinal fibrils of the non-striped muscle-cells, and you also are the first and till now even the only observer who studied, measured and pictured the different forms of these cells in different phases of contraction! In all the treatises on histology I know, only relaxed and extended cells are presented and described. In my lectures on physiology I always make drawings of the two extreme states, corresponding to your Figs. 3 and 15, but the latter (maximal contraction) only on the base of theoretical deductions. In future my students will see your figures, taken after nature.

When I get time I hope to repeat your observations and to study the microscopical changes in non-striated cells during contraction with the new microchemical and optical methods. But I fear I shall not come much farther than you have already been, nearly 40 years ago.—Believe me, with repeated thanks and the highest reverence,

Yours sincerely,

TH. W. ENGELMANN.

The next of Lister's investigations, although based on microscopical observation, is purely physiological. It dealt with the Early Stages of Inflammation, and was contained in a paper read before the Royal Society on the 18th June 1857, and published in the *Philosophical Transactions* for 1858, vol. 148. Like Wharton Jones, in making the observations on the inflammatory changes in the circulation, Lister used for the most part the frog's web, but in order to confirm his results upon warm-blooded animals, he also employed the bat's wing. The changes in the vessels were carefully observed and delineated. The paper is divided into sections. The first deals with the aggregation of the blood-corpuscles which occurs when blood is removed from the body; the second with the structure and function of the blood-vessels and the manner in which the arteries regulate the amount

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of blood transmitted to the capillaries; the third with the effect of irritants on the circulation of the part to which they are applied. In the fourth he describes the effects of irritants upon the tissues; and finally, he discusses the application of these observations to pathology, and deals with the mechanism of counter-irritation. As Sir Rickman Godlee remarks, "This paper impresses the reader by the beauty and simplicity of the experiments described, the originality of the thoughts, and the soundness of the reasoning."

His next investigation was brought before the Section of Biology, in 1857, at the Meeting of the British Association in Dublin. It was purely physiological, although based on microscopical observation. It concerned the Movement of Chyle in the Lymphatics of the Mesentery. Lister examined these vessels in mice, immobilised by chloroform, and records a slow regular flow along the lacteals, which, although furnished with plain muscle and numerous valves, showed no sign of rhythmic contraction, the flow being produced entirely by a *vis a tergo* caused by absorption from the intestine. [Possibly the chloroform used to immobilise the animals may have paralysed rhythmic contractions which might otherwise have occurred.] On adding a coloured material such as indigo to the food (bread and milk) he found he could detect no indigo particles in the chyle, and infers that, "the facts, though perhaps not entirely conclusive, seemed to throw great doubt on the possibility of absorption of solid matter by the lacteals;" a point a good deal believed in at that period, but now entirely given up.

A short time after this, stimulated by the recent discoveries of Claude Bernard, Augustus Waller, and Brown-

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Séquard upon the vasomotor nervous system in mammals, Lister set to work to examine the conditions of the circulation in the frog, with special inquiry into the Parts of the Nervous System which regulate the Contraction and Dilatation of the Arteries. His work on this subject, which involved many ingenious experiments, the observations being made on the vessels of the web with the aid of an ocular micrometer, was read to the Royal Society at the same time as the one on the early stages of inflammation, with which it necessarily has much in common. It was published in the same volume of the *Philosophical Transactions*. He concluded from his experiments that the cerebro-spinal axis regulates the contraction of the arteries, and that this function is exercised by the whole length of the cord and by the posterior part of the brain (medulla oblongata). He also infers that there exists within the limb some means, probably ganglionic, by virtue of which the fibre-cells of the circular coat of the arteries may contract in consort with one another, independently of any ganglion contained in the trunk. This last conclusion he arrived at by severing all connections between the trunk and peripheral part of the limb except the main artery and vein. He confirmed it by the remarkable and interesting observation that even in a tied-off amputated limb, the arteries continue for several days to exhibit slow contraction and relaxation, which he supposed—since at that time all rhythmic action was believed to be caused by nervous influences—must be due to the existence of peripheral ganglia. Lister had already made the observation that the arteries of the frog normally undergo rhythmic contraction and relaxation about eight times a minute—as is now known to be the case with those of the rabbit's ear—and in the observation of the prolonged survival of arteries after

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removal from the body, he anticipates, in the frog, the comparatively recent observations of MacWilliam upon the arteries of mammals.

On the same day that the papers, of which a brief account has here been given, were read, another narrating a still more remarkable series of observations On the Cutaneous Pigmentary System of the Frog was presented to the Royal Society, and is also published in the *Philosophical Transactions* for 1858. The changes in the colour of the skin and the pigmentary mechanism by which they are brought about had already been the subject of investigation by Brücke in 1852, and, in 1854, by von Wittich and Harless. Regarding the movements of the pigment-granules within the cells, all three agreed in the opinion that both the fluid contents of the cell (*i.e.* the cytoplasm) and the granules move together from one part of the cell to another, the offsets being completely empty of both when the pigment is accumulated in the middle of the cell. The observations of the above-mentioned authors had been made in the chameleon and in *Rana esculenta*, but Lister found that "the common frog of this country (*Rana temporaria*) . . . exhibits changes of hue almost as great as those of the chameleon." He describes the changes which occur in the pigment-cells and the manner in which these can be brought about by alterations in the environment, by nervous excitation direct and reflex, and by other conditions; he details also the minute structure of the cells, and the way they are connected together into a network which envelops many of the blood-vessels. He proves their "cellular" (cell) nature by showing the constant presence of a nucleus; he also describes the pigment-granules. He shows conclusively that the movements of the pigment-

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granules are not conditioned by the movements of the pale contents (cytoplasm) of the cell, but are due to transference of the granules from the peripheral parts to accumulate about the nucleus, leaving the "fluid cell contents" behind. No better description and delineation of the changes which occur in the frog's pigment-cells have appeared than are given in this paper published seventy years ago.

Lister further discusses whether the nucleus is the attractive (and repulsive) agent for the movements of the granules, and comes to the conclusion that it is not; also that the diffusion which occurs after concentration is not a passive reversal of the concentration, since he has seen the granules "start off suddenly from the central mass, with a velocity which implied that they were under the influence of forces very different from those which cause molecular movements in them when shed from their containing cells (Brownian movements)." He found the functions of the pigment-cells to be "under the control of the nervous system," and also that they undergo changes after death or amputation of a limb which, although not corresponding in point of time, offer a parallel to the alterations which he had described in the blood-vessels. It must be remembered that at that time nothing was known of the effects of internal secretions on the pigment-cells, and it is not to be wondered at that changes were ascribed to the direct action of the nervous system which are now known to be brought about through the agency of the secretions of the suprarenals and pituitary.

Lister was less fortunate in another conclusion he arrived at, which was also published in a paper in the *Philosophical Transactions* for 1858, vol. ix. (This paper on the Inhibitory System takes the form of a letter addressed to Dr Sharpey.) He appears to have started with a preconceived theory

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which is an entire departure from his usual practice, and he interprets the results of his experiments in terms of that theory. Thus he begins by recalling a conversation he had had with Sharpey. "You may possibly recollect my mentioning to you in conversation, when in London last Christmas, my suspicion that the phenomena in question (those of inhibition as shown by Weber's experiment of stopping the action of the heart by stimulating the vagus) were merely the effect of excessive action in nerves possessed of the functions usually attributed to them (*i.e.* of excitation or increase of functional activity)." Lister then proceeds to narrate the results of experiments upon the intestines in which he found that strong stimulation of the spinal cord caused the usual inhibition of the vermicular movements, whereas weak stimulation had the opposite effect, increasing the movements. The method of experimentation employed was, in fact, too crude to permit of so simple an explanation; especially since he had found that he was unable to get the same results when he employed chloroform to immobilise the animals. He, however, concludes quite rightly as the result of other experiments that "the intestine possesses an intrinsic ganglionic apparatus which is essential to the peristaltic movements and, while capable of independent action, is liable to be stimulated or checked by other parts of the nervous system." He is less happy in his attempt to refute the statement that section of the vagi is followed by increase of action of the heart—which he admits would be fatal to his theory—and he quotes five experiments, one on a calf and four on rabbits, in which he failed to get this effect. Why these experiments should have given a negative result it is not easy to say, for the positive result is constantly obtained in mammals, although it is often absent in the frog; in which animal, as is well known, the cardiac branches

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of the vagi contain the accelerator (sympathetic) fibres as well as the inhibitory fibres of the vagus itself.

The contributions which Lister made to the subject of Coagulation of the Blood have roused more attention than most of his physiological work, because they served to establish the principle that the blood is not subject to coagulation within the vessels unless the inner coat is injured or diseased, or unless a foreign body is introduced. Lister's attention seems to have been first drawn to the subject when he was considering the formation of a clot of blood blocking the arteries in the leg of a child, which he had amputated for gangrene of the foot. The appearance of the vessels in the amputated leg indicated that the primary disease was inflammation of the arteries, accompanied by coagulation of the blood contained within them, and the inference was that the blood had coagulated in consequence of the inflamed, *i.e.* diseased, condition of the arterial wall. It was well known to surgeons of those days that in order that a clot might form securely in a ligatured artery, it was necessary to tie the ligature tightly enough to cut through the inner coat. The above observation provided Lister with a text for an important dissertation on the causes of coagulation of the blood—a subject which, in 1859, was brought before the Medico-Chirurgical Society of Edinburgh. Finally, all the experiments and observations which he made on the subject were collected into the Croonian Lecture, delivered on the 11th June, 1863, before the Royal Society. This is the paper which is generally quoted, but it is important to remember that Lister's first work on the subject was done five years previously, and that it was called forth by a clinical observation for which he desired a physiological explanation.

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A large part of the Croonian Lecture is taken up in refuting a hypothesis which has long been forgotten, but which was much in evidence at the time, viz., that the blood fails to coagulate within the vessels because it contains a small amount of free ammonia, and only when the ammonia is allowed to escape can coagulation occur. This hypothesis was formulated by Dr B. W. Richardson and obtained so much credence that the Astley Cooper Prize of the Royal College of Surgeons of England, 1857, was awarded to him. It is not now necessary to recapitulate the arguments used by Richardson, whose theory was based on wholly false premises. But amongst other experiments quoted by Lister in its refutation is one which has become classical, having passed into the text-books under the designation of the "living test-tube experiment." In this he took two lengths of the jugular vein of an ox which had just been killed and still contained blood; he tied one end of each portion, stiffened the walls with spirally wound steel wire attached here and there to the outside of the vein, and everted the open ends so that blood could be poured from one "test-tube" into the other without coming into contact with anything but the uninjured inner coat of the vein with, of course, free exposure to the air and every facility for the escape of ammonia if present. But in spite of this Lister found that the blood kept fluid in the pieces of vein for from eight to ten hours; while, on the other hand, if an unopened vein full of blood was transfixed by a needle, so as to injure its inner coat and introduce a foreign body, a clot was readily formed.

Other experiments showed conclusively "that the blood as it exists within the vessels has no spontaneous tendency to coagulate and, therefore, that the notion of any action on the part of the blood-vessels to prevent coagulation [as

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against Brücke] is entirely out of the question. The peculiarity of the living vessels consists not in any such action upon the blood, but in the circumstance, remarkable indeed as it is, that the living membrane, when in a state of health, is entirely negative in its relation to coagulation, and fails to cause that molecular disturbance or, if we may so speak, catalytic action, which is produced upon the blood by all ordinary matter."

When we consider how many years it is since this was penned, we marvel at the accuracy of the conclusions at which the author arrives.

After this, Lister does not appear to have had time to deal at any length experimentally with purely physiological problems, but how keenly he was interested in them is shown by his paper read, in 1879, before the Hunterian Society of London, entitled "Effects of the Position of a Limb on the Circulation through it." In this he discusses the effect of position of the limb upon its vasomotor nervous apparatus; indeed, long before the introduction of the Esmarch bandage, he employed the elevated position of the limb to induce bloodlessness, which he ascribed not only to gravitation, but also to the reflex contraction of the arteries. He was able to confirm this view by an experiment on a horse, in which he observed that when the limb was elevated its arteries contracted, and when depressed they dilated.

In the same paper he describes an experiment whereby the blood, escaping from a small orifice in an artery, is made to write a pulse curve by being caught upon a horizontal sheet of paper moved along at right angles to the jet of blood. This experiment (hæmautograph) was not new, for it had been performed by Landois a few years previously;

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but Lister was unaware of this, and the designing of it is an indication of the ingenuity and, at the same time, the simplicity of all his experiments. It must, however, be admitted that the deduction he draws from it (as an exact indication of variations on blood-pressure) is not entirely warranted, since he leaves out of account the effect of variations in velocity, which in such a case are considerable. But the experiment shows how desirous he was of applying the study of hydrostatics and hydraulics to physiology and through physiology to practical medicine.

Finally may be mentioned two other physiological disquisitions—one the Oration delivered to the Medical Society of London in 1891, in which he deals in a comprehensive manner with the subject of blood-coagulation, but without bringing forward new experiments in confirmation of his views, which were indeed by that time universally accepted; the other the Huxley Lecture of 1900, in which he gives an account of his early physiological work. To this work he rightly attached great importance, although he seems to have been under the impression that others had been disposed to undervalue it. That this was the case may be in part true, but it was probably only due to its having been overshadowed by his later brilliant researches in connection with the germ theory; which, revolutionising as it did the practice of surgery, caused his earlier work to be overlooked. But it must be borne in mind that the one led directly to the other, and that the accuracy which he had learned to bring to his observations in physiology and microscopic anatomy stood him in good stead in his later work. All this shows that the importance of a training in physiology for the practical surgeon is abundantly illustrated by the history of Joseph Lister.

EDWARD SHARPEY-SCHAFFER.



JOSEPH LISTER, AGED 42.

Photograph taken in 1869, the year of his appointment as Professor of Clinical Surgery, University of Edinburgh.

IV

IPSISSIMA VERBA

In selecting for this volume two of Lister's numerous publications, choice has fallen upon his Introductory Lecture, as Regius Professor of Clinical Surgery in the University of Edinburgh, and the Address delivered in August, 1875, in opening the Surgical Section of the British Medical Association.

In the first, Lister expounds the germ theory of putrefaction upon which he founded the antiseptic system of treatment; in the second, he illustrates in a striking manner the effect of its application to practical surgery.

Under the title of "Obiter Dicta" a series of quotations culled from his Collective Writings gives an insight into the way in which Lister's thoughts constantly dwelt upon the great principle which recreated surgery as a science.

THE CAUSATION OF PUTREFACTION AND FERMENTATION

I STAND before you affected with very mingled feelings. On the one hand, I cannot but feel proud to have been called to occupy a Chair which, without disparagement to others, must be allowed to have been, during the last thirty-six years, the one most influential for good in this the most important medical school in the British dominions. But the exultation which I might otherwise naturally feel is heavily dashed by the thought that the circumstance which led to my promotion was the retirement of the man to whom the lustre of the Edinburgh Chair of Clinical Surgery has been from first to last entirely due. I am well aware that

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he has made the place, not the place him. And though in his presence I must not say all that I otherwise should, I cannot refrain from expressing my conviction that, whether regarded as a scientific and practical surgeon, or as a teacher of those principles which he has done more than any other man in this country to establish, he has been without a rival in the world. Hence, in addition to the grief which I feel in common with you all at the cause of his resigning the Chair which he had so long adorned, I am oppressed with a humbling sense of my own insufficiency; of my weakness, compared with his giant strength of mind and purpose; of my utter inability to fill his place. I can only strive, by the blessing of God, to do my best among you, relying, as I know I may, upon your generous sympathy. At the same time, we may all rejoice that our old master is still among us, to cheer us by his presence and aid us by his counsel; and it is a source of great satisfaction to myself that, as I have the privilege of free access to his inexhaustible store of wisdom and experience, he will, in some sense, through me be still your teacher.

I propose to devote this hour to the endeavour to convince you, so far as the limited time at our disposal permits, of the truth of the germ theory of putrefaction, the basis of a new mode of treatment which finds its application in all departments of practice; so that without understanding it we cannot advance satisfactorily in the consideration of individual cases. I allude to the antiseptic system. This system of treatment consists of such management of a surgical case as shall effectually prevent the occurrence of putrefaction in the part concerned. When this is really secured, surgery becomes something totally different from what it used to be; and injuries and diseases formerly regarded as most formidable, or even hopeless, advance

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quietly and surely towards recovery. Of this system the germ theory of putrefaction is the pole-star which will guide you safely through what would otherwise be a navigation of hopeless difficulty.

The germ theory declares that the putrefaction of organic substances under atmospheric influence is not effected, as used to be supposed, by the oxygen of the air, but by living organisms developed from germs floating in the atmosphere as constituents of its dust.

The first great step towards the establishment of this theory was the discovery of the yeast plant in 1838 by Cagniard-Latour, who, having detected in yeast a microscopic fungus, the *Torula Cerevisiæ*, which appeared to be the essential constituent of the ferment, attributed the resolution of sugar into alcohol and carbonic acid to the disturbing influence of the growing organism. In the following year, Schwann of Berlin published the results of a remarkable investigation into the cause of putrefaction, in the course of which, by a coincidence such as is not uncommon in the history of science, he, too, had independently discovered the yeast plant. He related experiments which showed that a decoction of meat might remain for weeks together free alike from putrefaction and from the development of infusoria or fungi in a flask containing air frequently renewed, provided that the atmosphere was subjected to a high temperature at some part of its course towards the containing vessel. Hence he concluded that putrefaction was caused by the growth of organisms springing from germs in the air, the heat preventing the putrefactive change by depriving the germs of their vitality. In other words, he propounded the germ theory of putrefaction. These experiments of Schwann appear to me to prove conclusively that oxygen, as ordinarily understood by chemists, cannot of itself occasion

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putrefaction. It is true, indeed, that, if you attempt to repeat the experiments, you meet with failure. But it must be remembered that merely negative results go for nothing here, if the positive evidence rests on satisfactory authority. This is a point which has been too little borne in mind in the discussion of this subject. If we consider what the germ theory assumes, how minute the putrefactive particles are supposed to be, and how universally present in the atmosphere, and in the dust which adheres to all objects exposed to it, it is easy to understand failure in such experiments consistently with the truth of the theory. But it is *impossible* to understand success in any single instance, consistently with the falsehood of the theory. If in any one case it really happened that a decoction of meat remained without putrefaction for weeks together, though freely exposed to air, unaltered, except by having been temporarily subjected to a high temperature, this is enough to show that oxygen, as known to chemists, is not the sole cause of the change in question. One genuine successful experiment out of a thousand is enough to establish that point.

Schwann's observations, however, did not receive the attention which they appear to me to have deserved. The fermentation of sugar was generally allowed to be occasioned by the *Torula Cerevisiæ*; but it was not admitted that putrefaction was due to an analogous agency. And yet the two cases present a very striking parallel. In each a stable chemical compound, sugar in the one case, albumen in the other, undergoes extraordinary chemical changes under the influence of an excessively minute quantity of a substance which, regarded chemically, we should suppose inert. As an example of this in the case of putrefaction, let us take a circumstance often witnessed in the treatment of large

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chronic abscesses. In order to guard against the access of atmospheric air, we used to draw off the matter by means of a cannula and trocar, such as you see here, consisting of a silver tube with a sharp-pointed steel rod fitted into it, and projecting beyond it. The instrument, dipped in oil, was thrust into the cavity of the abscess, the trocar was withdrawn, and the pus flowed out through the cannula, care being taken by gentle pressure over the part to prevent the possibility of regurgitation. The cannula was then drawn out with due precaution against the reflux of air. This method was frequently successful as to its immediate object, the patient being relieved from the mass of the accumulated fluid, and experiencing no inconvenience from the operation. But the pus was pretty certain to reaccumulate in course of time, and it became necessary again and again to repeat the process. And unhappily there was no absolute security of immunity from bad consequences. However carefully the procedure was conducted, it sometimes happened, even though the puncture seemed healing by first intention, that feverish symptoms declared themselves in the course of the first or second day, and, on inspecting the seat of the abscess, the skin was perhaps seen to be red, implying the presence of some cause of irritation, while a rapid reaccumulation of the fluid was found to have occurred. In these circumstances, it became necessary to open the abscess by free incision, when a quantity, large in proportion to the size of the abscess, say, for example, a quart, of pus escaped, fetid from putrefaction. Now, how had this change been brought about? Without the germ theory, I venture to say, no rational explanation of it could have been given. It must have been caused by the introduction of something from without. Inflammation of the punctured wound, even supposing it to have occurred, would not explain the

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phenomenon. For mere inflammation, whether acute or chronic, though it occasions the formation of pus, does not induce putrefaction. The pus originally evacuated was perfectly sweet, and we know of nothing to account for the alteration in its quality but the influence of something derived from the external world. And what could that something be? The dipping of the instrument in oil, and the subsequent precautions, prevented the entrance of oxygen. Or even if you allowed that a few atoms of the gas did enter, it would be an extraordinary assumption to make that these could in so short a time effect such changes in so large a mass of albuminous material. Besides, the pyogenic membrane is abundantly supplied with capillary vessels, through which arterial blood, rich in oxygen, is perpetually flowing; and there can be little doubt that the pus, before it was evacuated at all, was liable to any action which the element might be disposed to exert upon it.

On the oxygen theory, then, the occurrence of putrefaction in these circumstances is quite inexplicable. But if you admit the germ theory, the difficulty vanishes at once. The cannula and trocar having been lying exposed to the air, dust will have been deposited upon them, and will be present in the angle between the trocar and the silver tube, and in that protected situation will fail to be wiped off when the instrument is thrust through the tissues. Then when the trocar is withdrawn, some portions of this dust will naturally remain upon the margin of the cannula, which is left projecting into the abscess, and nothing is more likely than that some particles may fail to be washed off by the stream of outflowing pus, but may be dislodged when the tube is taken out, and left behind in the cavity. The germ theory tells us that these particles of dust will be pretty sure to contain the germs of putrefactive organisms, and if

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one such is left in the albuminous liquid, it will rapidly develop at the high temperature of the body, and account for all the phenomena.

But striking as is the parallel between putrefaction in this instance and the vinous fermentation, as regards the greatness of the effect produced, compared with the minuteness and the inertness, chemically speaking, of the cause, you will naturally desire further evidence of the similarity of the two processes. You can see with the microscope the torula of fermenting must or beer. Is there, you may ask, any organism to be detected in the putrefying pus? Yes, gentlemen, there is. If any drop of the putrid matter is examined with a good glass, it is found to be teeming with myriads of minute jointed bodies, called vibrios, which indubitably proclaim their vitality by the energy of their movements. It is not an affair of probability, but a fact, that the entire mass of that quart of pus has become peopled with living organisms as the result of the introduction of the cannula and trocar; for the matter first let out was as free from vibrios as it was from putrefaction. If this be so, the greatness of the chemical changes that have taken place in the pus ceases to be surprising. We know that it is one of the chief peculiarities of living structures that they possess extraordinary powers of effecting chemical changes in materials in their vicinity, out of all proportion to their energy as mere chemical compounds. And we can hardly doubt that the animalcules which have been developed in the albuminous liquid, and have grown at its expense, must have altered its constitution, just as we ourselves alter that of the materials on which we feed.

The only question, therefore, that remains to be answered is: Whence have these vibrios originated? Have they sprung, like higher animals and plants, from pre-existing

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similar organisms, or have they arisen spontaneously out of the pus from an alteration in its physical constitution, determined in some inexplicable manner by the introduction of a cannula and trocar?

All analogy, gentlemen, is in favour of the former view. The doctrine of spontaneous or equivocal generation has been chased successively to lower and lower stations in the world of organised beings, as our means of investigation have improved. I remember a conversation I once had, when a student, with an elderly gentleman, not indeed belonging to our profession, on the subject of mites in cheese. He believed that they grew out of the cheese from some change in its substance as the result of keeping; and the view which I advocated, that they had sprung from the eggs of pre-existing mites, seemed to him preposterous. But when the microscope is applied to these creatures, and we see that they rank in the type of their organisation with spiders or crabs, and that they are similarly provided with organs of reproduction, it seems to us as absurd to suppose that they have arisen from a mere alteration in the cheese as it would be to imagine that crabs could spring spontaneously out of a piece of dead fish or other garbage upon which they prey. Yet though no physiologist doubts that cheese-mites do arise from parentage, it must be confessed that there is some difficulty in accounting for their almost invariable occurrence in some kinds of cheese kept for a sufficient length of time. Whether the eggs are transferred by the hand of the cheesemonger, or whether the adult mites migrate from cheese to cheese, may be matter for curious discussion.

But though with creatures as large, comparatively speaking, as the cheese-mite, it may not be very easy to explain the extensive diffusion of their ova, this difficulty becomes less and less the more minute the organism. If

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a vessel containing preserved fruit is left exposed to the air, the surface of the preserve soon becomes covered with mould, and it is then found to have a "mouldy" flavour—implying alteration in its chemical constitution. The mould itself has a flavour of its own, and it has developed, in part at least, at the expense of the preserve. If the mould is examined microscopically, it is seen to be just as distinctly a vegetable as a cabbage is, and far more abundantly provided with reproductive apparatus. Supposing it to be the ordinary blue mould, the blue tint is simply the colour of the fructification. This is in accordance with a general law in the organic world, that so far from any deficiency appearing in the arrangements for reproduction in the lower forms of life, so as to make it difficult to account for their originating from parents, the lower the organism the more lavishly is this provided for.

In some animals low in the scale of being we find, besides the formation of ova, a faculty of self-multiplication by segmentation, or, as it is termed, fissiparous generation. For what purpose, I venture to ask, can be this ample provision for reproduction of the lowest species by parentage, if they can spring spontaneously out of the materials in which they grow?

Now, in the case of the blue mould, the sporules, besides being produced in incalculable multitudes, are of extreme minuteness, and constitute a very fine dust, which cannot fail to be wafted and extensively diffused through the air. If a ray of sunlight were to shoot through this room, we should see the sunbeam peopled with motes. But the particles of dust which are rendered visible to the naked eye by being so illuminated, are gross indeed compared with the sporules of such a fungus. Some of them are complicated organic structures, such as pieces of hair or

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vegetable fibre ; and if these are suspended in the air, still more must microscopic spores be so, though their extreme minuteness makes it less easy to distinguish them from particles of inorganic matter. Hence it appears that, for the lowest forms of life, as for the highest, the notion of spontaneous generation is simply gratuitous and uncalled for.

But although from these considerations we may be led pretty surely to infer, on the one hand, that the atmosphere is pervaded by the germs of minute organisms, and, on the other hand, that without such germs the organisms could not take their origin, it would be highly desirable to obtain positive evidence on both these points, if indeed it is attainable.

Such evidence has been afforded of late years by the beautiful researches of Pasteur. From among his numerous experiments, I will select one set as peculiarly instructive. A number of glass flasks, with attenuated necks, were partially filled with a decoction of yeast, filtered so as to be perfectly clear and transparent. Each was then boiled for a certain length of time, with the object of destroying any organisms existing in the decoction, or adhering to the interior of the vessel, and during ebullition the neck was hermetically sealed, so that when the vessel cooled, a vacuum was produced in the part previously occupied by air. A certain number of such a series of flasks were then opened in a particular locality, as, for example, a lecture room such as this, by breaking the narrow neck of each, after scratching it with a file. Air rushed in to fill the vacuum, after which the neck was immediately sealed again with the blow-pipe. As the result of the introduction of this limited amount of air, the previously transparent liquid in a considerable proportion of the flasks was seen to present, in the course of the next few days, a cloudiness indicative of the first

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appearance of the growth of *torulæ* and other organisms, which afterwards continued to increase. But if a set of such flasks were opened in a situation where atmospheric germs might be expected to be few, if any, a different result was obtained. M. Pasteur was at the pains to take such flasks to the Mont Anvert, in Switzerland, and open them in wind blowing from a glacier, taking special care, by exposing the neck to the flame of a spirit-lamp when filing it, and breaking it with long forceps similarly treated, to guard as much as possible against the introduction of living organisms from the instruments employed, or from his own person. The pure air thus introduced had indeed, in one flask out of twenty, the effect of inducing, very slowly, an appearance of organic development. But in all the rest the liquid remained perfectly unchanged for an indefinite period. On the other hand, if the flasks were opened in a situation where the air, though in one sense pure, might be expected to abound in minute life, viz., under the shade of trees in the country, organisms formed in sixteen out of eighteen flasks, and presented a great variety in their nature. These experiments, which rest not only on the high authority of M. Pasteur, but also on the unimpeachable corroborative testimony of a Committee of the French Academy of Sciences, including the celebrated Milne Edwards, prove conclusively both that the gases of the air cannot of themselves occasion the growth of organisms, even in a very favourable nidus for their development, and also that in regions inhabited by plants or animals, whether in cities or in the country, nearly every cubic inch of atmosphere really does contain living germs floating in it.

But there is one other experiment related by Pasteur, which is in some respects even more striking. A flask is prepared similar to those already described, except that,

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after the introduction of the decoction of yeast, the neck is not only drawn out into a pretty narrow tube, but bent at various angles. The fluid is then boiled as in the former experiments ; but the end of the neck, instead of being sealed, is left open, so that air passes into the flask on withdrawal of the lamp. The vessel being then left undisturbed, the diurnal changes of temperature, involving alternate expansion by day and condensation at night of the gases in the flask, necessitate a daily interchange between the air in the body of the flask and the external atmosphere. Yet the fluid, though exposed in this way to air perpetually changed, remains for an indefinite period quite transparent, without trace of organic development. There can be but one interpretation of this fact. The oxygen, whether in its ordinary condition or that of ozone, with all the other atmospheric gases, including any which may exist in such small quantities as to be undiscoverable by the chemist, must pass, each in its own proportion, unchanged into the body of the flask. It is impossible that a dry glass tube can stop any gas. For though the tube is moist from condensation of aqueous vapour in the first instance, it is soon dried by the air that passes in and out through it. It is, therefore, inconceivable that any atmospheric gas can have been arrested by the tube. But it is conceivable, considering the very gradual character of the movements of the air in consequence of the diurnal changes, that dust, even though very fine, may be arrested by the angles. We may, perhaps, wonder that particles of such extreme minuteness as the germs of atmospheric organisms should be so detained. But no one can say it is impossible, and no other possible explanation presents itself. The experiment proves with certainty that the gases of the air, however abundantly supplied, are of themselves unable to originate the growth

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of torulæ and the other minute organisms which appear in decoction of yeast freely exposed to the atmosphere; and also that the essential source of such development must be suspended particles or germs. But in order to render the experiment, if possible, still more conclusive, the Committee of the Academy completed it by sealing the end of the neck of the flask, after the fluid had remained clear for a sufficient length of time to show that no organisms could grow in it, and inverting and shaking the vessel till some of the liquid passed into the angles of the bent tube, after which the flask was again left to itself. And now, gentlemen, occurred something which you may perhaps be disposed to regard as too good to be true, but which is true nevertheless. In the course of no long time the fluid in the angles of the tube exhibited indications of organic growth, demonstrating that the sources or germs of such development had, as a matter of fact, been arrested there.

This experiment charms us alike by its simplicity and perfect conclusiveness. Here is evidence indeed, which, if the facts be admitted, cannot be gainsaid. But though I could not doubt the authority on which it rested, I felt desirous, if possible, to bring it to bear more directly upon the subject of putrefaction. The fluid which seemed most likely to answer the purpose, combining transparency with a high degree of putrescibility, was urine, and I accordingly made it the subject of the experiment to which I now desire to direct your attention. Two years ago last month, I introduced portions of the same specimen of fresh urine into four flasks, of which two are before you. The body of each vessel was about one-third filled with the liquid. After the introduction of the fluid, the necks of three of them were drawn out into tubes rather less than a line in diameter, and then bent at various acute angles, as you

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observe in one of these. In the other the neck was drawn out to a calibre if anything rather finer, but cut short and left vertical, as you see it. The liquid in each flask was then boiled for five minutes, the steam issuing freely from the open end of the narrow neck. The reason for boiling it so long is that, as Pasteur has shown, merely raising this fluid to the temperature of 212° F., and then allowing it to cool, is not enough to kill all the organisms it may contain. It is necessary to maintain the elevated temperature for about five minutes to ensure complete destruction of their vitality. The lamp being then removed, air of course passed in to take the place of the condensed aqueous vapour. And during the two years that have since elapsed, a considerable fraction of a cubic inch of fresh air has entered every night into the body of each flask to exert its influence upon the liquid. In the case of the flasks with contorted neck, the air moving to and fro through the tube soon dried the moisture which was at first deposited within it; and any of you may see, after lecture, that in the one before you the neck is dry as well as open from end to end, so that it could present no obstacle to any gaseous constituent of the atmosphere. Nevertheless, though thus freely exposed to the action of the gases of the air for so long a period, including two unusually hot summers, the urine still retains its original straw colour and perfect transparency, presenting neither cloud, scum, nor sediment; and the only change that I can detect in it is, that of late, as a result, I presume, of the slow evaporation that has been going on in consequence of the perpetual change of air, some very minute shining crystals have been deposited upon the sides of the glass. Similarly unaltered are the contents of the other two similar flasks which I have not thought it needful to bring here. But very different is the appearance of the urine in this

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other flask, whose neck, short and vertical, was calculated to admit particles of dust as well as gaseous material. The transparent straw colour has given place to a muddy brown, with abundant sediment, including the debris of different fungi, which have long since ceased to grow, poisoned, no doubt, by the acidity of the liquid, the pungently ammoniacal character of which may be readily ascertained by placing the warm hand for a moment upon the body of the flask, while one nostril is kept above the orifice.

Soon after the commencement of the experiment, this short-necked flask had a really beautiful appearance. Two different kinds of fungi presented themselves — one of exceedingly delicate structure growing rapidly from the bottom of the vessel, so as to occupy in no long time the greater part of the bulk of the liquid; the other a dense blue mould floating at the surface, and extending slowly in concentric rings. Meanwhile the fluid gradually assumed a deeper and deeper amber tint, indicative of progressive change in its chemical composition.

In the case of the flasks with bent necks I was not content with observing the completely unchanged appearance of the contained urine. Half a year after the experiment was begun I poured out about half an ounce of the clear contents of one of them into a wine-glass for examination. Its odour was perfectly sweet, and its reaction faintly acid; and under the microscope a careful search with an excellent glass of high power failed to detect vibrio, bacterium, or any other organism. The lowest known forms of organic development and the slightest approach to putrefactive change had been alike prevented by simply filtering the air of its floating molecules.

Yet the urine which had so long remained unaltered under the free influence of the gaseous constituents of the

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atmosphere proved as prone as ever to the usual effects of exposure to the air as soon as particles of dust could gain access to it ; for the wine-glass having been covered to avoid evaporation, I found the fluid in two days with a dunghill odour, and loaded with minute microscopic organisms, and a few days later different kinds of fungi visible to the naked eye were growing in it.

Gentlemen, I commend these facts to your candid and impartial judgment, beseeching you to form your own opinions regarding them. The minds which you bring to bear upon this subject to-day are very much the same as they will be throughout your lives. An observation which any one of you may make now will serve in after life to illustrate a course of lectures, should he occupy a position corresponding to that which I have now the honour to hold. And you are as competent as you ever will be to draw logical inferences from established data. Do not, then, let any authority shake your confidence in knowledge so obtained.

THE EFFECT OF THE ANTISEPTIC TREATMENT UPON THE GENERAL SALUBRITY OF SURGICAL HOSPITALS.

I believe I can hardly more profitably occupy the time allotted to me for an address than by bringing before you some facts illustrative of the effect of antiseptic treatment, when strictly carried out, upon the general salubrity of surgical hospitals.

Six years ago, when writing on the very remarkable improvement which had been brought about by "enforcing strict attention to the antiseptic principle" in the wards of which I had charge in the Glasgow Royal Infirmary,



THE OLD ROYAL INFIRMARY, EDINBURGH (the north front facing Infirmary Street).

The building is now demolished, but the Gateway stands in Drummond Street opposite the entrance to the Physics Department of the University of Edinburgh.

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"converting them from some of the most unhealthy in the kingdom into models of healthiness," I ventured to express myself thus : "Considering the circumstances of those wards, it seems hardly too much to expect that the same beneficent change which passed over them will take place in all surgical hospitals, when the principle shall be similarly recognised and acted on by the profession generally." That prediction, I think I may say, is now in course of fulfilment.

I shall speak first of what has come to my knowledge with regard to some foreign hospitals, and I will begin with Copenhagen, where Professor Saxtorph long ago introduced antiseptic treatment ; indeed, I believe he was the first to bring it into operation on the Continent. The large hospital of which he had the charge used to be a very unhealthy one. Pyæmia was extremely frequent, even after very small operations, such as amputation of a finger. Pyæmia has vanished ever since the antiseptic treatment was introduced, hospital gangrene has almost entirely disappeared, and erysipelas is nearly unknown except as imported from the town. Professor Saxtorph writes to me as follows : "If you ask me what I have observed respecting the effects of antiseptic treatment, I may say that it has not modified, but completely changed my principles of pathology and my surgical practice. . . . The word *hospitalism*, which some years ago found its way from Edinburgh to the Continent, no longer terrifies us ; it no longer keeps us from performing operations in the infirmary, and you seldom meet with a case that could be called a case of hospital disease. As to accidental deep wounds, large lacerated wounds of the scalp, contused wounds with smashing of hand or foot, compound fractures or wounds of joints, I almost invariably have them heal without any bad symptoms, by means of antiseptic dressing and drainage-tubes. Any case of this sort will

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almost certainly recover if there is no complication of shock, or gangrene of the limb, or contusion of internal organs. In short, I think I am right in saying that patients very seldom die from an operation. If they do die, it is not the operation that kills them, but the disease that existed previously to the performance of the operation."

I come now to what I witnessed in the course of my recent travel in Germany, and I shall speak only of those hospitals into which antiseptic treatment has been introduced. Of these, the first I saw was Munich. The large Allgemeines Krankenhaus there has been until lately increasingly unhealthy; pyæmia was very frequent; and hospital gangrene, which made its appearance in the year 1872, had become annually a more and more frightful scourge, until last year it had reached the astounding proportion of 80 per cent. of all wounds that occurred in the hospital, whether accidental or inflicted by the surgeon. And not only was it thus extremely frequent, but was in a very severe form, produced frightful ravages, often caused death, and led to patients who recovered being retained an inordinately long time in the hospital. But, from the time when, at the beginning of the present year, efficient antiseptic treatment was brought into operation by Professor Nussbaum, they have not had one single case of hospital gangrene. At the time when I was at Munich, they were doubtful whether they had had one case of pyæmia; erysipelas, formerly very prevalent and severe, was rare, and, when it did occur, was in a very mild form; and I saw the convalescent wards—which previously had always been filled and overflowing—standing one after another empty, because the patients, no longer affected with hospital gangrene, recovered much more rapidly.

I next proceeded to Leipzig, where Professor Thiersch

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is clinical teacher. He has three hundred beds under his own charge, of course seconded by able assistants. Professor Thiersch was the first to introduce antiseptic treatment on scientific principles into Germany. His results, as regards the general salubrity of the hospital, have been, on the whole, progressively more and more satisfactory, and in the present year he was able to state that he had only had one case of pyæmia in twelve months; and that, you will observe, in a service of three hundred beds. Hospital gangrene, also, had almost disappeared. There had been in 1871 a curious attack of that disease in two barrack wards, which seemed to be due to old hospital furniture piled up in an empty space under those apartments; but of late this also has vanished. Professor Thiersch has more recently used, instead of carbolic acid, salicylic acid as an external dressing; but he still employs carbolic acid for the spray and lotion. Salicylic acid, as he uses it, certainly works very well; but that his increasingly satisfactory results are due to any special virtues of that agent cannot be maintained.

From Leipzig I passed to Halle, where I found Professor Volkmann carrying out antiseptic treatment just in the same way as we do here. He gave an antiseptic demonstration, to which he invited professors from various parts of Germany; and he certainly showed us a magnificent set of cases. It was, I confess, somewhat gratifying to me that Professor Volkmann had obtained his results without any of his assistants having visited Edinburgh. Seeing the importance of the subject, he had worked in good earnest at the system, in accordance with what he had read of my writings. He told me he had only gradually got into the way of carrying out the system properly; but I had the satisfaction of seeing everything done exactly as we do here, and with results of the most brilliant kind.

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I also learn that hospital gangrene is now entirely unknown in that hospital. Erysipelas likewise is extremely rare ; and, where it does appear, it is of a superficial and mild type.

Amongst the cases brought before us in Professor Volkmann's demonstration was one of excision of the hip-joint, where putrid sinuses had existed before the operation. About a week had passed since the operative procedure, but there was no purulent discharge whatever ; and no fluid even of a serous character could be pressed out from the small spot that alone remained unhealed, and the use of a drainage-tube had been already given up. In short, the case had followed the typical course we expect under antiseptic treatment when we operate with an unbroken skin. This is a kind of result I myself had never yet obtained, and it filled me with astonishment. I inquired how it had been arrived at, and I found it was as follows. Professor Volkmann several years ago strongly advocated the application to diseased soft parts of "the sharp spoon" which had been introduced into German surgery by Brüns, of Tübingen, for scraping carious bone. In this case, Professor Volkmann had cleared out the offending substances altogether, and then introduced an antiseptic lotion ; and he told me, to my amazement, that it was the rule with him to attain results of the character I then witnessed. If my journey on the Continent had been one of unmixed labour, I should have thought that labour well rewarded by this circumstance in my visit to Halle. I have already put this plan in operation in my own practice since my return. Whether I can obtain such frequent success as Professor Volkmann, I do not know ; but I have already succeeded in some cases.

In Berlin, Professor Bardeleben, with one hundred beds under his care at the Charité Hospital, has long introduced

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the antiseptic system. The hospital used to be a very unhealthy one. Pyæmia was so frequent, that amputation in the lower limb was almost certain death to the patient ; but, through antiseptic treatment, this has for a long time past been entirely changed. Professor Bardeleben informed me, at the time of the meeting of this Association in London, that pyæmia was practically abolished from the wards, without any other change than the introduction of antiseptic treatment ; and I found that this same satisfactory condition of things continued at the time of my visit this year. Erysipelas was also rare, and of a mild type ; and hospital gangrene very uncommon. At the same time, I feel bound to express my conviction that Professor Bardeleben would get still better results had he not been led, on the score of economy, to substitute for our antiseptic gauze unprepared gauze soaked with a watery solution of carbolic acid ; for here, the carbolic acid being dissolved in a liquid, instead of being stored up in an insoluble medium, the antiseptic and its vehicle are both displaced together by the discharge which soaks into the dressing, and this involves great additional risk. In fact, Professor Bardeleben told me that for very special cases he still used our antiseptic gauze.

In the other great clinical hospital of Berlin, the renowned and veteran surgeon Von Langenbeck had not until the present year seen his way to adopting antiseptic treatment. He had professed admiration of various results he had heard of ; but, as Professor Bardeleben said, it had been barren admiration. But it was a singular coincidence, and one very gratifying to me, that, when I called upon him, I found him preparing to perform his first operation according to strict antiseptic principles. The case was one of tumour of the upper end of the fibula ; and, considering the possibility of the wound communicating with the knee-joint, he felt himself bound to

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use antiseptic treatment. This he did with perfect faithfulness, in spite of the serious inconvenience of a most unnecessarily wetting spray; and, when the operation was concluded, he did me the honour to ask me to put on the dressing.

At Magdeburg, I found a great hospital, containing, on the average, one hundred surgical patients. This hospital used to be noted for its unhealthiness; but I learned that, since the introduction of antiseptic treatment, an entire change had come over it in this respect. Pyæmia has almost entirely disappeared, hospital gangrene has gone, and erysipelas, when it occurs, is of a very mild type.

At Bonn, also, I heard similar testimony. I learned from Professor von Busch, who introduced antiseptic treatment into the clinical hospital last year, that some previously unhealthy wards had since quite changed their character; and that in some fine airy wards, which were always very free from hospital disease, the mode of healing of the wounds was something altogether different from what it used to be.

So much, then, gentlemen, for my Continental experience. And now I wish to say a few words as regards the Infirmary here, where I have now been at work for about six years. And, first, as to the conditions under which I am working. The wards, as some of you have seen, are small and overcrowded. These wards were never so severely tested as they have been since I came here. There used to be, in the old High School building, two reserved wards kept ready for the reception of erysipelas or other peculiar cases; but, at the time when I was appointed, twenty beds were taken off from the clinical surgical department for the purpose of creating a new surgeony; and, at the same time, the two reserved wards previously kept empty



THE SURGICAL HOSPITAL, OLD ROYAL INFIRMARY, EDINBURGH,

In which Professor James Syme and Professor Lister taught and worked. Prior to 1829 the building was the Royal High School.
It is now occupied by the Engineering Department of the University of Edinburgh.

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were filled with patients. That particular block of building has, therefore, been more severely tried than ever it was before. The number of beds is so limited that there is always great pressure upon them. When I came to Edinburgh from Glasgow, seeing the beds so close, I had several of them cleared out; but the result was, I found, that the same number of patients were admitted; and there always being a considerable proportion who could walk about during the day, they were put down on mattresses on the floor at night, so that the number of patients remained as before; and, as the wards continued perfectly healthy, I had the beds reintroduced. But, more than this, I have still the mattresses on the floor. If you were to go into these wards sometimes at night, you would be surprised to see how many "shake-downs" there are. We have, also, often two or three children in one bed; and altogether by these means, while I have fifty-five beds, I have lately had seventy-one patients. During the time I have been here, there has hardly been a day on which there have been as few patients as beds, although any of you can see that those beds are not as distant from each other as they ought to be, according to modern notions of what is requisite for the salubrity of a hospital.

Then there is another important respect in which my wards have been more severely tried than before. There had previously always been an annual cleaning of the wards of our Infirmary. Now, this involves considerable inconvenience. The patients had to be transported to another part of the hospital, and some cases were liable to be injured by this transport. Therefore, when the annual cleaning came about, I used to consider whether the patient would get more harm from the want of the clean-

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ing of the wards, or from the transportation. I thought they were more likely to get harm from the transport; and this being year after year my conviction, it is now three years since any cleaning took place in these wards of mine. The year 1872 was the last in which it was practised, except in the case of one individual ward where a sore throat prevailed last summer, which seemed to be of the nature of scarlatina, and on that account the ward was emptied and purified. I have sometimes observed remarks made with regard to the results of treatment in my wards, to the effect that I work under superior hygienic conditions. It is, in truth, exactly the opposite. My wards, in these respects, are more severely tried, I believe, than those of any other surgeon in the kingdom.

Then it is said that greater cleanliness is involved in the antiseptic treatment. This, again, is an entire mistake. If we take cleanliness in any other sense than antiseptic cleanliness, my patients have the dirtiest wounds and sores in the world. I often keep on the dressings for a week at a time, during which the discharges accumulate and undergo chemical alteration, probably from oxidation and the action of the resin of the gauze upon them; and, when the wounds are exposed after such an interval, the altered blood with its various shades of colour conveys often both to the eye and to the nose an idea of anything rather than cleanliness. *Æsthetically* they are dirty, though surgically clean.

There is yet another way in which my wards have been unusually tried—namely, that I now perform operations which, without antiseptic means, I should not have considered justifiable, some of them being of a character which used to involve especially the risk of pyæmia, such as cutting down on ununited fractures of the femur, and removal of the ends of the fragments.

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Yet, in these circumstances, if I have had one case of pyæmia where I have operated myself, it is the only one I know of; and that was a spurious form of the disease. It occurred in a patient from whom I had removed the mamma, and, at the same time, cleared out all the axillary glands; and putrefaction took place in the axilla, in consequence, as we had reason to believe, of mismanagement of the spray. Of hospital gangrene we have not had one single case during these six years. As regards erysipelas, our experience has been various. As a rule, it is very rare in my wards. I have been two entire years without a single case of it; but, on the other hand, there was a time when it was frequent. This was during a concurrent epidemic of small-pox and erysipelas in Edinburgh two years ago. The erysipelas was of a very virulent type, and some patients in private practice in the city died of erysipelas affecting the puncture of revaccination.

One objection that has been urged against my treatment is the inordinate length of time patients remain in hospital. No doubt it is so in some cases; but, as a rule, these are instances in which we expect to cure otherwise incurable cases, such as spinal abscess. But, on the other hand, on comparing Mr Syme's case-books with my own, during two periods of three years, the unexpected result has lately been arrived at that, in proportion to my number of beds, I have had a larger number of operations than Mr Syme; showing that, while some patients, kept alive by antiseptic treatment, have remained long in the hospital, this was more than counterbalanced by the rapid cure of others.

I trust, gentlemen, that the facts which I have now had the honour to bring before you will be considered pretty strong proof of the value of strict antiseptic treatment in promoting the general salubrity of surgical hospitals.

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ADMITTING, then, the truth of the Germ Theory, and proceeding in accordance with it, we must, when dealing with any case, destroy in the first instance once for all any septic organisms which may exist within the part concerned; and after this has been done, our efforts must be directed to the prevention of the entrance of others into it. And provided that these indications are really fulfilled, the less the antiseptic agent comes in contact with the living tissues the better, so that unnecessary disturbance from its irritating properties may be avoided.

The simplest conditions are presented by an unopened abscess. Here, as no septic particles are present in the contents, it is needless to apply the antiseptic directly to the part affected. All that is requisite is to guard securely against the possibility of the penetration of living germs from without, at the same time that free escape is afforded for the discharge from within. When this is done we witness an example of the unaided curative powers of Nature as beautiful as it is, I believe, entirely new.

In compound fractures and other severe contused wounds the antiseptic agent must in the first instance be applied freely and energetically to the injured parts themselves, the conditions being the opposite of those in unopened abscesses. The wound being of complicated form, with its interstices loaded with extravasated blood, into which septic organisms may have already insinuated themselves during the time that

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has elapsed before the patient is seen by the surgeon, mere guarding of the external orifice, however effectually, is not sufficient. After squeezing out as much as possible of the effused blood, a material calculated to kill the septic particles must be introduced into the recesses of the wound; and if the substance employed is of sufficient strength to operate to a certain extent as a caustic, this is regarded as a matter of little moment in comparison with the terrible evil of inefficiency in its antiseptic action. For experience has abundantly shown that parts killed in this way, including even portions of bone, become disposed of by absorption and organisation, provided that the subsequent part of the treatment is properly managed.

Upon these principles a really trustworthy treatment for compound fractures and other severe contused wounds has been established for the first time, so far as I am aware, in the history of surgery.

"Illustrations of the Antiseptic System of Treatment in Surgery."
(*Lancet*, 1867, vol. ii., p. 668.)

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Throughout the Course on which we are entering I shall endeavour, as far as possible, to place before you simple facts—trusting that, in estimating their significance, you will be ever guided by that which our dear master has so constantly striven to inculcate as our leading principle, the love of Truth.

Gentlemen, I commend these facts to your candid and impartial judgment, beseeching you to form your own opinions regarding them. The minds which you bring to bear upon this subject to-day are very much the same as they will be throughout your lives. You are as competent as you ever will be to draw logical inferences from established data. Do

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not, then, let any authority shake your confidence in knowledge so obtained.

"Introductory Lecture as Regius Professor of Clinical Surgery, delivered in the University of Edinburgh, 8th November, 1869."

The danger of chloroform may be compared, not inaptly, to that of railway travelling. In both cases the risk incurred by any individual is so small that it does not enter seriously into our calculations. And just as railway accidents are generally occasioned by culpable mismanagement, so death from chloroform is *almost invariably* due to faulty administration.

"On Anæsthetics." (Holmes' *System of Surgery*, vol. iii., third edition, London, 1883. Part II. Written 1870.)

The antiseptic system does not owe its efficacy to some specific virtue in the agent employed, nor can it be taught by any rule of thumb. One rule, indeed, there is of universal application—namely this: *Whatever be the antiseptic means employed (and they may be very various), use them so as to render impossible the existence of a living septic organism in the part concerned.* But the carrying out of this rule implies a conviction of the truth of the germ theory of putrefaction, which, unfortunately, is in this country the subject of doubts such as I confess surprise me, considering the character of the evidence which has been adduced in support of it.

Lancet, 1870, vol. ii., p. 287.

The antiseptic treatment is continually attracting more and more attention in various parts of the world; and,

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whether in the form which it has now reached, or in some other and more perfect shape, its universal adoption can only be a question of time. The noble institutions of which our country is justly proud, admirably adapted alike for the treatment of the sick and the instruction of the student, will then be cleared of the only blot that now attaches to them—the malignant influence of impure atmosphere.

"On the Effects of the Antiseptic System of Treatment upon the Salubrity of a Surgical Hospital." (*Lancet*, vol. i., pp. 4, 40, 1870.)

Among the causes which have hitherto interfered with the general acceptance of the antiseptic system, by far the most prejudicial is the doubt of its fundamental principle, instilled by various authors who have opposed the germ theory of putrefaction, and who, supposing themselves to be advocating the cause of truth, have not only, as it appears to me, espoused the side of error, but have unconsciously inflicted an amount of material evil upon their fellow-creatures such as mere speculative opinion is seldom able to produce. For few medical men in active practice have the leisure to sift and weigh the facts and arguments of such a discussion; yet, if they lose firm faith in the guiding principle of the treatment, the attainment of a full measure of success becomes with them a matter of impossibility. "*Felix qui potuit rerum cognoscere causas*" was never more applicable than here.

But I do venture earnestly to beg of all of you who are engaged in surgical practice, that you will give these simple facts your careful consideration; and if you think the interpretation I have given a sound one, do not let any statements, whether in books or in journals, shake your belief in the truth

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that putrefaction, under atmospheric influence, as it occurs in surgical practice, is due to particles of dust ever present in the atmosphere that surrounds our patients, and endowed with wonderful chemical energy and power of self propagation, yet happily readily deprived of energy by various agents which may be employed for the purpose without inflicting serious injury upon the human tissues. With this as your guiding principle, you will find yourselves successful with the antiseptic system of treatment; but without it, whatever theory you adopt, you will ever be walking in the dark, and therefore ever liable to stumble.

After statements of this conclusive character have been published regarding what is generally admitted to be the most urgent medical question of the day, when I consider the apathy with which they have been received in many quarters, I cannot avoid being reminded of the language of Macbeth—

“Can such things be,
And overcome us like a summer's cloud
Without our special wonder?”

I am sure that, however much the means of carrying out the antiseptic principle may come to vary from those which we now use, the principle itself will certainly be ultimately recognised as the most important of all those that shall guide the practice of surgery; and the sooner our profession is aware of this, the better will it be for suffering humanity.

“Address in Surgery at the Thirty-ninth Annual Meeting of the British Medical Association, Plymouth, 10th August, 1871.”

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The philosophical investigations of Pasteur long since made me a convert to the Germ Theory, and it was on the

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basis of that theory that I founded the antiseptic treatment of wounds in surgery. The results of the treatment pursued constantly on this guiding principle have convinced me more and more of the truth of the theory upon which it was based ; and if I were to put together the facts which I have had presented to me in surgical practice, proceeding on the antiseptic system, I should be able to present an array of evidence in favour of the Germ Theory as good and convincing as experiments performed in a laboratory.

Transactions of the Royal Society of Edinburgh, vol. xxvii., 1875.

Here we have before us a patient with a distended knee-joint. You observe this peculiar, limited, special bulging, which, together with the history, makes me suspect that the joint is on the eve of suppuration.

I have said that this case will be an example of the antiseptic treatment in its simplest form. The antiseptic will not be introduced into the joint ; it will not be applied to the affected part at all. It will be merely employed externally to prevent the access of septic mischief while we provide exit for fluid from the interior. We shall first purify the skin with a strong (1 to 20) watery solution of carbolic acid, which is best for detergent purposes ; water holding carbolic acid but slightly, and very readily giving it up to act upon anything else. Carbolic acid has a remarkable penetrating property. It blends with oily substances and animal matters, and penetrates the hair and hair-follicles, and therefore such a washing as I am now giving will render the skin absolutely pure, surgically speaking. This is a very great point.

In the next place, we shall have an antiseptic atmosphere

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provided by means of this spray producer, which acts on the principle of Siegle's steam inhaler.

The part to be operated upon, then, being in an antiseptic atmosphere, if the finger is to be introduced into the wound (and I shall very likely have to pass my finger into the joint) you must take special care that it is an aseptic finger; and this is done by cleansing it with an antiseptic solution, making sure that it passes well into the folds of skin about the nail. And if I should have to introduce an instrument into the articulation, I must see that it is always pure when inserted. In order, gentlemen, that you may get satisfactory results with this sort of treatment, you must be able to see with your mental eye the septic ferments as distinctly as we see flies or other insects with the corporeal eye. If you can really see them in this distinct way with your intellectual eye, you can be properly on your guard against them; if you do not so see them, you will be constantly liable to relax in your precautions. I have known of a gentleman with every anxiety to carry out antiseptic treatment, exploring the wound in a case of fracture of the skull, and, the probe happening to fall to the ground, it was taken up from the dusty floor, and immediately passed into the depths of the wound. Now, gentlemen, that was but courting failure. What more likely than that some of the septic dust, which certainly was brought up adhering to the bloody probe, should pass into the wound without having been sufficiently acted on by the spray in the moment of transit, and, mingling with the blood in the interior, be there protected for the future by the blood-clots from the antiseptic influence of the dressings, and induce putrefaction? If we could see the septic material upon the instrument as distinctly as we could see green paint in contrast with the red blood, then of course we should say, we must wash off this green poison; but because we cannot

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see it with the physical eye, we are always liable to make mistakes through neglect of using proper precautions ; and I am more and more persuaded, the longer I practise anti-septic surgery, that the chief essential to success is a thorough conviction of the reality of the presence of the septic matter on all objects in the world around us.

"Demonstrations of Antiseptic Surgery before Members of the British Medical Association." (*Edinburgh Medical Journal*, vol. xxi., 1875-76.)

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It were far better that the antiseptic method should not be employed at all than that it should be used imperfectly. For such attempts not only end in disappointment, but throw discredit on the system. Some people seem to say, "I have tried the thing and failed and therefore, of course, the system is all nonsense."

I have seen it fail in my own practice, but in such circumstances I have always thought that there must have been some mistake on my part, and I have endeavoured to discover where my mistake lay.

If we could dispense with the spray, no one would rejoice more than myself ; but until somebody wiser than I am can supply some better means, we must continue to use it.

Edinburgh Medical Journal, vol. xxi., 1875-76, pp. 193, 481.

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You are probably by no means sufficiently alive to your deficiencies ; for it is an unfortunate property of ignorance that it is ever unaware of its own existence.

Let us ever contend against prejudice ; and remembering

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that the glorious truth is always present, let us strive patiently and humbly to discover it.

In investigating Nature you will do well to bear ever in mind that in every question there is the truth, whatever our notions may be. This seems, perhaps, a very simple consideration, yet it is strange how often it seems to be disregarded.

If we had nothing but pecuniary rewards and worldly honours to look to, our profession would not be one to be desired. But in its practice you will find it to be attended with peculiar privileges; second to none in intense interest and pure pleasures. It is our proud office to tend the fleshly tabernacle of the immortal spirit, and our path, if rightly followed, will be guided by unfettered truth and love unfeigned. In the pursuit of this noble and holy calling I wish you all God-speed.

"Promoter's Address, Graduation in Medicine, University of Edinburgh, August, 1876."

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I desire to correct a mistake into which I fell when investigating the fermentation of milk some years ago; for, next to the promulgation of new truth, the best thing, I conceive, that a man can do, is the recantation of published error.

Trans. Pathological Society of London, vol. xxix., 1878.

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I appeal to the logical faculty of this great assembly of eminent men, and beg them to consider carefully in relation to this question the familiar case of a simple fracture or

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dislocation. Do we feel anxiety regarding the state of the constitution of a patient who has received such an injury? The mischief done is in itself of a worse character than the surgeon ever inflicts. Yet so long as the unbroken skin shields the bruised and lacerated tissues from the access of materials coming from the external world, repair advances safely, no matter what be the constitutional condition; the exceptions being so extremely rare that we practically leave them out of consideration altogether. It therefore surely follows that if we could contrive a treatment of our wounds which would have all the advantages of the unbroken integument, we might operate without anxiety on account of the constitution.

To provide a condition of our operation-wounds that shall put them fully on a par with subcutaneous injuries is plainly the ideal of our art. Towards the attainment of this ideal we have already made large progress; and towards its full achievement, so far as it be possible, I would earnestly invite the best efforts of my hearers.

Simplification of our means of procedure is no doubt in itself highly desirable, and I have already indicated one direction in which it may possibly be attained. But the safety of our patients incomparably transcends such a consideration, and it would indeed be a grievous thing if our desire for simplicity should induce us in any degree to relax our efforts to carry out the strict antiseptic principle, the strenuous endeavour so to deal with wounds as to prevent from first to last the development in them of pathogenic organisms. The means by which this object may be most surely and at the same time most conveniently attained will, no doubt, vary greatly in the future in accordance with our ever-advancing science; but whatever modifications we

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may admit in our methods, let us at all events never be satisfied with any that does not yield results at least as good as those which it is now in our power to secure.

"An Address on the Treatment of Wounds, delivered before the Surgical Section of the International Medical Congress, London, August, 1881."

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As regards the spray, I feel ashamed that I should ever have recommended it for the purpose of destroying the microbes of the air. If we watch the formation of the spray and observe how its narrow initial cone expands as it advances, with fresh portions of air continually drawn into its vortex, we see that many of the microbes in it, having only just come under its influence, cannot possibly have been deprived of their vitality.

Yet there was a time when I assumed that such was the case, and, trusting the spray implicitly as an atmosphere free from living organisms, omitted various precautions which I had before supposed to be essential.

"Address on the Present Position of Antiseptic Surgery, delivered before the International Medical Congress, Berlin, 1890."

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I may remark that it pleases me, as the years pass, to see the hope which I expressed at the International Congress in London eleven years ago in course of fulfilment, namely, that the use of the antiseptic system would gradually spread by leavening action throughout the world.

"Address on the Antiseptic Management of Wounds, delivered at King's College Hospital, in the London Post-Graduate Course, 18th January, 1893."

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There is one golden rule for all our experiments upon our fellow-men. Let the thing tried be that which, according to our best judgment, is the most likely to promote the welfare of the patient. In other words: "Do as you would be done by."

Pasteur's labours on fermentation have had a very important influence upon surgery. I have been often asked to speak on my share in this matter before a public audience; but I have hitherto refused to do so, partly because the details are so entirely technical, but chiefly because I have felt an invincible repugnance to what might seem to savour of self-advertisement. The latter objection now no longer exists, since advancing years have indicated that it is right for me to leave to younger men the practice of my dearly loved profession. And it will perhaps be expected that, if I can make myself intelligible, I should say something upon the subject on the present occasion.

When Pasteur had shown that putrefaction was a fermentation caused by the growth of microbes, and that these could not arise *de novo* in the decomposable substance, the problem of putrefaction in wounds assumed a more hopeful aspect. If the wound could be treated with some substance which, without doing too serious mischief to the human tissues, would kill the microbes already contained in it and prevent the future access of others in the living state, putrefaction might be prevented, however freely the air with its oxygen might enter. I had heard of carbolic acid as having a remarkable deodorising effect upon sewage. Applying it undiluted to the wound, with an arrangement for its occasional renewal, I had the joy of seeing these formidable injuries follow the same safe and tranquil course as simple fractures, in which the skin remains unbroken.

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Even our earlier and ruder methods of carrying out the antiseptic principle soon produced a wonderful change in my surgical wards in the Glasgow Royal Infirmary, which, from being some of the most unhealthy in the kingdom, became, as I believe I may say without exaggeration, the healthiest in the world; while other wards, separated from mine only by a passage a few feet broad, where former modes of treatment were for a while continued, retained their former insalubrity. This result, I need hardly remark, was not in any degree due to special skill on my part, but simply to the strenuous endeavour to carry out strictly what seemed to me to be a principle of supreme importance.

" Presidential Address, British Association, Liverpool, September, 1896."

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I must confess that highly, and very highly, as I esteem the honours which have been conferred upon me, I regard all worldly distinctions as nothing in comparison with the hope that I may have been the means of reducing in some degree the sum of human misery.

" Speech at Conferring of the Freedom of the City of Edinburgh, 15th June, 1898."

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The principle that first guided me, still retains, I believe, its full value, and the endeavour to apply that principle so as to ensure the greatest safety with the least attendant disadvantage has been my chief life-work.

" The Third Huxley Lecture, delivered before the Medical School of Charing Cross Hospital, October, 1900."

V

THE INFLUENCE OF LISTER'S WORK ON SURGERY

The Philosophies of Lister's Genius

I HAVE found it a difficult thing to write of the influence of Lister's work on surgery; perhaps I have been embarrassed by the very richness of the theme. There are many ways in which the subject may be treated, but I have been attracted by, and therefore I have chosen, the wider, less concrete influences of his work; what one may term the philosophies of his genius, those great principles of his personality which will live long after experiment and result have been forgotten.

We live in a world of change; many aspects of Lister's work, brilliant and original as it was, have passed out of our immediate focus. Milestones they were, marking a renaissance in this work-a-day world, but our faces are towards the future, and our thoughts with the present, and the individual events of his great career are, to many, only of historical interest. Milestones are often but the evidence and the reminder of the great postulates of space and time, and so it is with Lister's work. In the surgery of the future it may well be that antisepsis and asepsis will be but landmarks pointing the way and marking the distance to a new age, but with the great principles by which these were erected it is altogether otherwise; they are everlasting, like all great principles.

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It seemed to me, therefore, a right thing that one should consider what I have called the philosophies of Lister's genius, and the influence of these on surgical art and science.

And when the Day had come there was a Man Peculiarly Endowed

It is one of the strongest of natural laws that, when conditions are such that some great transformation is necessary, the medium, suitably prepared, makes its appearance. When the "corn is ripe, the shearer is ready." Logicians may argue the rationality of *post-hoc* and *propter-hoc* in this so constant manifestation of demand and supply, but to ordinary people the comfort lies in the inevitability of the law. Lister's appearance in the sphere of surgical activity was at a time which may be described as peculiarly appropriate. Medicine as a collective science had been making considerable strides. The political revolutions in America and France had intensified the demand for intellectual and moral liberty, which was inevitably reflected in medicine in common with the other sciences. A demand for sufficient hospital accommodation and the insistence that the treatment of the sick poor should be a community burden received a stimulus from the moral ebullition which the political conflagrations had started. In fact, shortly prior to Lister's advent there was a great accession to what, for want of a better word, one may term "the material" upon which the evolution of medical culture must, in part at least, depend.

With the advent of the nineteenth century the inception of the organised advance of science became apparent. It might be said that Lister's *magnum opus* was intimately dependent upon chemistry, physics, and physiology, subjects related at all times to surgery, but peculiarly so when

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we consider the special type of work with which Lister was concerned. In all of these, the early years of the nineteenth century saw a renaissance which bore fruit in the work which he conceived and accomplished. Justus von Liebig and Friedrich Wöhler in Germany, Dumas and Chervreuil in France laid the foundation in experimental chemistry of Claude Bernard's work in physiology, of Pasteur's discoveries in the field of physical chemistry and bacteriology, and of Lister's investigations in relation to sepsis, blood coagulation and ligature technique.

The progress of the physical sciences kept pace with that of chemistry, and it is of special interest in this connection to note that Lister's work must have been simplified, if it was not actually made possible, by the improved microscope, for which his father, Joseph Jackson Lister, devised the improved achromatic lenses, and to which Amici had given the idea of water immersion, and Chevalier the compound objective.

It has been said that Lister was essentially a physiological surgeon, and the description is an apt and a correct one if we assume it to mean that he followed physiological principles in the experiments which he carried out and in the methods which he applied to surgical technique. In physiology the progress was perhaps greater than in any other branch of medical science, and Lister himself has recorded in his letters the debt which he owed to William Sharpey, William Bowman and Albert von Kölliker.

It was into an atmosphere of this nature that Lister came. Educational and economic evolution had emphasized, as never before, the crying need for a wider medical and surgical attention. The related sciences had advanced to a point at which their discoveries and developments could be applied in practice. Into this field, so appropriately prepared, Lister

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stepped, specially endowed, mentally, traditionally, and even economically, for he was singularly blessed in so far as he never knew the grim necessity of "*il faut vivre*," and the demands which the shibboleth implies. One might say, as Byron wrote of Sheridan—

"Sighing that Nature formed but one such man
And broke the die in moulding Sheridan."

It seems as though one must turn these thoughts over in one's mind before one can assess the influence of Lister on surgery, that one must have some conception of the exceptional endowment of the man who played so great a part in revolutionising surgical art and science. Others will paint the picture of what surgery was before the influence of Lister's work became apparent, and I venture to say that the outline will be a sombre, even a repulsive one. It would in some ways be a sufficient answer to the query implied in the title of this paper to reproduce, as *vis-à-vis* to that grim record, the picture that might illustrate to-day, to say that in that great contrast lies the surest and most telling answer to the question, "What influence has Lister had on surgery?"

Such a picture, however, simple, impressive, and accurate though it be, is insufficient, for this great transformation surely merits close consideration. There is substance in it for a thousand essays, and the voices of millions have arisen to call it blessed. Let us therefore ask ourselves the question—Wherein lay the magnitude of Lister's accomplishment? What are the great ethical and spiritual principles which stand out from his labours, jewels that scintillate in a coronet of gems?

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The Art of Healing was Created Anew

It may truthfully be said that Lister created anew the art of healing. Through the long centuries surgery had been improving and developing. Enormous strides had been made in the knowledge of anatomy, physiology and pathology, and it is obvious that, as the standard of these reached a higher level, surgical art benefited in respect of diagnosis, and in the explanation of symptoms and clinical signs. In fact, there were men of Lister's time, high in the standing of their profession, who were fully satisfied with the existing state of affairs. Tilanus, Professor of Surgery in Amsterdam, presiding in 1840 at a meeting for the advancement of surgical knowledge, said: "Surgical art is at present within measurable distance of being perfect," a statement which to us must seem amazing, and a declaration of great significance; for, if it is accepted that Tilanus expressed the consensus of the surgical opinion of his time, we can only assume that the attitude was one of never having known a better in reality or in dreams. To us, looking back, it seems nothing less than Lethe's gloom.

Into this distressing atmosphere of dark self-complacency there stepped a man whose vision pierced the veil, who saw, beyond the barrier, the limitless possibilities of a future brighter than could have been imagined in the wildest dream. He was as—

"One who lived in a maelstrom of sorrow,
Who dreaded the round of each day,
Who said, 'But there must be a morrow,
A brighter, less sorrowful way.'"

These lines were the heart thoughts of one who lived long before Lister's day, yet they express in some measure the feelings that must have swayed his thought and mind. "Is there not a better way? Are there no means of dissipating

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the shadows of infection and of death that overcast the work of our hands?" These questions must have persistently occupied his thoughts. His genius lay in the answer he gave to these questions, for the challenge was accepted—there must be a brighter and a less sorrowful way. Lister found it, and by so doing he created anew the art of healing.

Let us think for a moment what this has meant to our profession. A new creation! Hitherto, whatever advances collateral sciences might make they could not be applied to surgery, because too often the simplest wound of the surface led to suppuration, and it might be to disaster. It was as though the human body were encased in a magic covering; let the smallest tear occur in this, and through that portal there entered that which might send the strongest to destruction.

We can imagine the sense of mystery and of fear which must have surrounded an incident so inexplicable, and we can sympathise with the attitude which limited operative surgery to the simplest and the most urgent procedures. There seemed to be no way out of the difficulty; it was an *impasse* which inevitably meant the limitation of any operative procedure to within the narrowest limits. Like a strong man struggling to burst his bonds—fettters apparently slender as gossamer, yet stronger than steel—surgery tolerated the incubus of infection, unable to apply in its own field the discoveries which the sciences were beginning to announce. Cribbed, cabined, and confined, there could be no real progress in surgical art so long as men worked under the shadow of an ever-threatening disaster. With the golden key of genius Lister unlocked the gates which had never hitherto been opened, and the stream thus released is now a torrent of great volume, carrying our art to regions which time alone can reveal.

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He bestowed upon an Art the Heritage of a Science

Among the greatest of Lister's achievements was his successful effort to put surgical work upon such a footing that it fulfilled, in part at least, the exacting definition of a science. A scientist has been defined as one who is concerned with "the investigation, the scrutiny, and the weighing of facts," and the definition is as applicable to the best type of surgical investigator as it is to the chemist, the metaphysician, or the engineer. Anyone who reads Lister's papers cannot fail to be impressed by his extraordinary passion for facts, his desire for accuracy of observation and precision of statement. Man, unscientific man, is often content with the nearly and the almost: Nature never is, and too often it is in the neglect of this golden rule that failure lurks.

In the opinion of many, the capacity for accurate observation and the care which he took to confirm his observations were the most distinguishing features of Lister's mind and work. He fulfilled, as few men have, the high ideal which Huxley set when he wrote: "The longer I live the more obvious it is to me that the most sacred act of a man's life is to say and feel, 'I believe such and such to be true.' All the greatest rewards and all the heaviest penalties of existence cling about that act." The sceptical, almost distrustful, yet scientific desire to test everything, is well expressed in the definition of a *professor* given in *Fliegende Blätter*: "Ein Professor ist ein Mensch der anderer Meinung ist"—A professor is a man who is of a different opinion.

Lister applied to surgery this attribute of scientific doubt, of painstaking, laborious observation and of ceaseless observation of facts. What had hitherto been an art—a handicraft—became a science, and one of living and real intensity, a force so virile that the work still travels forward by reason

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of the momentum which was then imparted to it. He realised that there is no alleviation for the sufferings of mankind except through veracity of thought and of action, and the resolute facing of the world as it is when the garment of make-believe, by which pious hands have hidden its uglier features, is stripped off (Huxley).

We know not in what direction the future of surgery may travel, but we must be for ever grateful for the hall-mark of scientific worth which our profession received by reason of Lister's work. From the hands of those who had gone before him he inherited a handicraft ; to those who came after him he bequeathed a science.

He realised the Hopes which had sustained the Ages

Sir Frederick Treves once said that the greatest achievement of Lister was the fact that he made a reality of the hopes which had for all time sustained the surgeon's endeavours. History tells us how long was the pedigree of that endeavour. The seed was sown when the priests of ancient Egypt embalmed their dead with palm oil and cassia, and the Etruscans preserved their wine by adding a modicum of pitch ; but the seed fell on barren ground—at least it grew so slowly that the nineteenth century was more than half spent before the plant grew to full fruition.

The world is familiar with the fascinating story of the long and weary pilgrimage, and, looking back upon it in the light of to-day, one appreciates how narrow was the margin which separated the shades of superstition and empiricism from the joyful flood-light of a life-saving discovery.

“How first beholding, they beheld in vain,
And hearing, heard not, but like shapes in dreams
Mixed all things wildly down the tedious time,
Nor knew to build a house against the sun.”

(ÆSCHYLUS).

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It was in the later years of the seventeenth century that the first signs of the true dawn appeared, for it was at this time that Leeuwenhoek recorded his discovery of micro-organisms, and Redi, the Tuscan poet, disproved the theory of spontaneous generation by his now famous and classical experiments with gauze-protected meat. Straws in the wind! But a little more, and the world might have travelled by a very different road, but, in effect, two centuries were to elapse before the significance of these discoveries and experiments was appreciated. Yet could it very well have been otherwise? Lister's achievement was not the chance discovery of a sudden inspiration, the fruits of a brilliant hypothesis, the pearl of great price found by one who but sought his daily bread; rather was it the culmination of a long line of observation and experiment. A man arose who saw the crying need. He used the lessons which the past and the present afforded him. With a sense of logic which bore the stamp of genius he applied the lessons to his work as he found it, and, in the light which these postulates engendered, surgery has gone forward to its present height.

This aspect of Lister's work bears a lesson which we shall do well not to forget. The great cosmopolis we call our world is but a stage of many players, a huge mosaic, each part depending on its fellow, and only when each has fallen into place does the real principle or pattern find expression. Peculiarly endowed—and I like to think it was scarcely so by chance—Lister submitted himself to a training which seems as though it was particularly adapted to the work he accomplished. He picked up the multitude of threads which lay around him, the experiences of others, past and present; he saw the grim necessity which implored relief, and out of this vortex of endowment, experience and opportunity, he fashioned a weapon which has revolutionised

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a suffering world. Antisepsis had a multitude of leaders in its long and weary journey to the Pisgah Peak, but it was reserved for the genius of Lister to conduct the precious burden from Mount Nebo into the promised land of reality.

"Fiat Experimentum—Fiat Lux"

Observation and experiment are the hubs of the scientific universe; in the former we study the natural course of events, in the latter we arrange artificially for certain things to occur. If medicine and surgery are to continue to advance they will do so by the continued application of these two great principles. Observation, the study of the natural course of events, is a means of information which is open to everybody; experiment too, at least in its simplest forms, is at everyone's hands.

Prior to Lister's day surgeons rarely practised experimental work. Many of them were famed, and rightly so, for the multiplicity and the accuracy of their clinical observations, but, as far as experiments were concerned—the artificial production of events which they were anxious to test in confirmation or otherwise of their clinical observations—records are largely silent. How different is the position to-day. Experimental surgery has come to occupy a real and important position in our work. Departments of experimental surgery now form a part of the teaching arrangements of our great universities, and in America senior students are taught experimental surgery as a part of the regular course. Lister was among the earliest to show the value of experimental work in relation to surgical procedure.

The importance of Pasteur's work was appreciated by three men in particular, Jules Lemaire, Spencer Wells, and Joseph Lister. There may have been others, very probably

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there were, but as far as these three men are concerned, they made written record of their appreciation. Yet how differently they used the knowledge which lay to their hands. Lemaire recognised in some measure the value of carbolic acid as an antiseptic, but his sense of judgment failed to see its limitations. It became to him a panacea for a great variety of diseases; he advocated its use in such a variety of ills that ridicule was poured upon both the substance and its sponsor, and the idea was killed so far as Lemaire and his associates were concerned. Spencer Wells used Pasteur's work and its relation to surgery as the theme of his address at the Meeting of the British Medical Association in 1864, but we have no evidence that he carried his ideas, pregnant with possibilities though they were, beyond the stage of hypothesis. The way in which Joseph Lister used the knowledge is a matter of history.

We may well ask ourselves why these men, all of outstanding ability, should use their opportunity so differently. As far as we can judge at this distance of time the original chances were very even; Lemaire may have been handicapped by the want of hospital opportunities, but his general practice was a large one, and he did a considerable amount of surgery. The brilliance of Spencer Wells's hypothesis is startling. Yet to one man alone was the prize of the great achievement awarded. And the reason? Because Lister saw something finer, higher, grander in the application of Pasteur's discovery to suffering humanity. Height above height, or, as Emerson expressed it in his beautiful picture of the little child looking up through the maple branches,

"Over his head were the maple buds,
And over the tree was the moon,
And over the moon were the starry studs
That drop from the angels' shoon."

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A sense of vision, a conception of the great possibilities, were not in themselves, however, sufficient. Spencer Wells's prescience was equally acute. Lister proceeded to exploit his dreams by a carefully planned experimental inquiry; therein lay the vital difference, for, by embarking on the line of careful experiment, he entered the avenues of logic and of reason—the means by which he could either prove or disprove that which his brain had formulated.

This feature of test and experiment is apparent throughout every step of his professional career: a personal detail of a minor nature may be quoted to illustrate this point. Watson Cheyne records—

“Often when Lister took off his coat and turned up his shirt-sleeves preparatory to dressing a case (for the days of sterilised gowns had not yet come), one would see several patches of dressing over his arm stuck down with collodion or strapping, and would wonder what injuries he had sustained and how. Foreigners especially took a great interest in these patches. These were in reality pieces of gauze impregnated with various kinds and strengths of antiseptics which he had fastened to his arms so as to test whether or not they were irritating to the skin, and if so in what strength. If the tests were satisfactory he would test them next on a small, unimportant wound.”

To my mind this record speaks volumes in respect of the great sense of logic which controlled the workings of that superb mind. Lister's influence on surgery? Here is a lesson which should be inscribed on the portal of every centre where graduates and undergraduates meet and work, and it might be put in the well-known words of Comte—

“INDUCTION FOR DEDUCTION, WITH A VIEW TO CONSTRUCTION.”

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"There was the Prophet's Vision"—(LONGFELLOW)

One of the strongest elements in the successful prosecution of any undertaking is an overwhelming faith in the importance of the work in hand. Mirabeau, watching the face of young Robespierre, exclaimed: "That man will go far, for he believes every word he says." Those who have recorded their impressions of Lister (and they are very many and very varied) have almost without exception referred to the outstanding sincerity of the man to his ideal. I have found it difficult to discover the exact time at which the vision came to Lister, the knowledge of the great work which lay to his hands, the Augean stables awaiting the cleansing by the Alphaen river of antiseptics. It may well have been one of the earliest impressions gained in the days when he acted as a dresser in the surgical wards at University College Hospital, but, whether early or late, the vision, once gained, never faded. Several witnesses have alluded to a sense of mysticism which surrounded Lister, the features those of one who sees visions and dreams dreams; but there is no great leadership where there is not a mystic. Nothing splendid has ever been achieved except by those who dared believe that something inside themselves was superior to circumstances, and in the pursuit of the great secret the follower finds that detachment which to the world around savours of mystery.

But wherein does this fulfil the claim of the influence of Lister's work on surgery? There is an old English proverb which runs: "Get an ideal—life becomes real," and Richard Stoddard, who wrote that little gem of poetry, "The Castle in the Air," says:

"Without the sombre real,
Within our heart of hearts the beautiful ideal."

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This is an age of materialism, and the distinction between the manners and ethics of our lives and those of 1860 is greater than the lapse of years would indicate. In one respect particularly it seems to me our lives are poorer—we have little time to give our minds to the great ideals of our work ; we are concerned with the daily routine, in getting through a vast amount of work, in amassing statistics, in breaking records—all very good, no doubt, and much of it essential to the age we live in ; but a price has been paid and is being paid, and part of that price is the sacrifice of those conditions in which ideals grow, the quiet waters of meditation and reflection. To me, one of the imprints which Lister left on surgical work has been the splendour of an ideal.

Our work is full of mysteries, of difficulties and of doubts, risks and uncertainties. The ideal which Lister saw and achieved removed a mountain of mystery and filled a valley of doubt, but our path is still strewn with obstacles as terrible as those which Lister smoothed away. Is it that some of us cannot see the wood for the trees? Are we concentrating on a “thousand peering littlenesses” while winged ambitions soar around? If it be so, we are but as one clothed in motley, idly passing by, and we are forgetting one of Lister’s greatest heritages—the value of an ideal in surgical work.

JOHN FRASER.

VI

REMINISCENCES OF 'THE CHIEF'

I

MY personal recollections of Lister carry me back nearly sixty years. In the early days of November, 1869, introductory lectures were given in Edinburgh by two newly appointed Professors; by Alexander Crum Brown, the successor of Lyon Playfair, and by Joseph Lister, appointed by the Crown on the retirement of James Syme.

In the chemistry classroom in the Old University buildings on the South Bridge, Lister delivered his first lecture. For several reasons the audience was unusually large. A Glasgow Professor translated by the Crown to Edinburgh was, to many who were present, hardly a *persona grata*; yet his work on antiseptic surgery was being noised abroad and the students, at any rate, more numerous than usual, were desirous of hearing about it.

I remember well the procession into the classroom, the marked quiet during the delivery of the lecture and the close attention given to it. I had never listened so intently to any lecture. The subject was new to me. The facts were so clearly and logically set out that I thought there could hardly be any other side to the question.

Lister was then about 42 years of age, just in his prime, with a commanding figure and a beautiful, thoughtful face. The earnestness with which he spoke increased the slight hesitancy of speech peculiar to him, yet adding force to his words. I think all who heard him speak felt that a new era of surgical work and teaching had opened in Edinburgh. He claimed to be endeavouring to treat

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surgical cases in such a manner as to prevent the occurrence of putrefaction in the part concerned. "If this is done," he said, "injuries formerly regarded in the gravest light, become comparatively trifling, and some diseases, rarely admitting of cure, terminate most satisfactorily in perfect recovery. The guiding principle of its practical details is the germ theory of putrefaction."

At this time John Hughes Bennett, the able professor of physiology in Edinburgh, was a strong upholder of spontaneous generation, as were Huxley and Charlton Bastian. Many held a contrary view. The greatest of these was Pasteur. Lister's experiments were very similar to those of Pasteur. He showed us one in which he introduced fresh urine into flasks—some with contorted necks, some with straight necks—pointing out the difference in the results, shortly after, and months after, the fluid had been introduced. Others had tried these experiments and failed. Lister answered these failures by saying: "Negative results are far less strong than positive. It is easy to understand failure in such experiments consistently with the truth of the theory; it is impossible to understand success in any single instance consistently with the falsehood of the theory."

In 1870, Lister gave me a dressership. On my first cases I used the Lac plaster with protective oil silk underneath. The plaster had replaced the putty used in Glasgow. Then came the gauze. I remember so well the first gauze dressing. During the preceding night Lister had toiled to obtain a small piece perfected to his satisfaction. He brought it to the Infirmary and with his staff went to the laboratory and made a larger portion. He proceeded to the operating theatre, where he corrected a badly united fracture of both bones of the forearm, dressing the wound with gauze; such was his confidence in the gauze. Much the same material,

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though impregnated with different constituents or with none, is used to-day. I never saw a poultice, lint or lotion used in Lister's wards, although they were in constant use by all the other surgeons during my student days.

In the following year I became a clinical clerk. At this time numerous distinguished surgeons from the continent attended the daily ward visit. Lister, painstaking to a degree, explained the theory and minutiae of his dressings. His own countrymen were rarely seen in the wards. Thomas Annandale and Joseph Bell endeavoured, not very successfully, to use his methods. John Chiene was a whole-hearted follower of Lister and, in the absence of the latter, took charge of the wards. I always found Chiene a careful and most considerate Chief.

At the end of my clerkship, Lister promised me his house-surgery, but urged me first to be a house-physician. After serving with Dr George W. Balfour I went, in 1874, to Lister. Syme had seventy beds, but the Board of Management had only given fifty-four to Lister. The wards were always overcrowded, often as many as seventy patients being accommodated. In the newer wards of the other surgeons, with their lofty ceilings, conditions were much more favourable. Yet with the exception of one case of septicæmia following amputation of the breast, I never saw a case of blood-poisoning in Lister's wards. This was not the general experience in the Infirmary. If Lister had not had the greatest confidence in the protective power of his system against such calamities, he would never have allowed the overcrowding.

Sunday afternoon was always a busy time in the wards. About two o'clock Lister arrived at the Infirmary. Cases that had not been overtaken in the pressure of the week's work were investigated, minor operations performed and

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many interesting points discussed. Very pleasant indeed were those Sunday visitations; all his staff appreciated and enjoyed them.

Through his old pupils, especially his old house-surgeons, his teaching was gradually disseminated. Cleaver went to Liverpool; Fleming and Beatson (now Sir George) to Glasgow; Knowsley Thornton to assist Sir Spencer Wells at the Samaritan Hospital for Women in London; Mallock, his old Glasgow house-surgeon, was in Hamilton, Canada. I went to Toronto, where St George Baldwin soon followed me. In 1876, I read before the Canadian Medical Association the first paper on antiseptic surgery in Canada. The subject was new to my audience. They were quite interested, but hardly able to discuss it intelligently.

St George Baldwin gives a striking instance of how patients quickly recognised the difference between the old and the new surgical practice. An old man, whose right foot had been removed by Mr Syme, came back to the Infirmary with a malignant tumour of the tibia. Mr Lister amputated the thigh. Some days later, Baldwin asked him how he was getting on. He replied, "Oh fine." Then laying down the paper he was reading, said, "Eh man, but you have made grand improvements since last I was here." If Lister's fellow-surgeons were very tardy in their recognition of his work, his patients were not.

After leaving Edinburgh in 1875 and settling in Toronto, I did not see Lister until 1886. I visited England in that year. At King's College Hospital I slipped into the theatre unobserved, I thought, while he was operating. Time had changed him somewhat; the brown hair was heavily tinged with grey, and spectacles were necessary for operating. In all other respects he was unaltered. I fancied perhaps he would not remember me, but after the operation was over

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he washed his hands in his usual deliberate manner and, looking round the seats he, smiling, said, "Where is that fellow?" He shook me warmly by the hand and made me promise to dine with him in the evening. After dinner, Rickman Godlee, his nephew, and others left the table, but Lister sat on, telling me of the changes and improvements that he had made and the difficulties overcome since I had been with him. It was eleven o'clock when we went upstairs, to find only my wife and Lady Lister in the drawing-room. His absorbing interest in his great work had made him oblivious to time and place.

When the British Association met in Toronto in 1897, all Canadians delighted to honour him. During the visit I saw much of him. He seemed to enjoy talking of the past; of his wife, to whom he was devotedly attached, and of her sad and sudden death when travelling in Italy. I saw him only twice afterwards. His last letter to me was dated June 1907, in which he said that he was in infirm health, but it would give him much pleasure to see me at Park Crescent. Unfortunately, I did not go to England during that summer; but two years afterwards, I found he had gone to Walmer and his return was a matter of great uncertainty.

F. LE M. GRASETT,
Dresser, 1870; Clerk, 1871; House Surgeon, 1874.

II

WHILE following the clinical teaching of Mr Lister in the Infirmary in the early seventies, it was evident to me that we were standing at the commencement of a new era in surgery.

To us, who were in immediate association with him, it was a constant astonishment to observe how indifferent the surgeons were to his work, which was, even in its earliest developments, already improving results by eliminating the fatal infections that took such a terrible toll of operation cases. The greatest trial that I think he had to bear was the neglect on the part of those who should have been the first to have recognised and valued the work he was doing. Instead of this, he received little but hostile and would-be destructive criticism. Lister, however, bore himself throughout this period of opposition with cheerfulness, always working to improve the effectiveness of the antiseptic method of dressing.

The secret of his imperturbable temper and self-restraint under provocation, I am sure, was the consciousness that he was right ; for on one occasion he said to me, "The day will come when the man who does not practise antiseptic surgery will be the one to be criticised."

During my student days, I had the privilege of being present on an historical occasion, when, for the first time, Lister used catgut prepared with chromic acid. Desiring to find some means of producing a catgut ligature that might be trusted to hold securely the largest arteries, he prepared a sample, treating it with chromic acid. One day after the

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conclusion of the hospital visit he took Professor Küster of Berlin, then visiting his wards, the house-surgeon and myself, to the Royal Veterinary College, where he placed the chromic acid ligature on the carotid artery of a horse. The ligature proved an unqualified success and the use of such subsequently became general.

During the early days of antiseptic surgery, new and unexpected things happened. I shall relate one.

In the winter of 1875-6, when I was his house-surgeon, a patient suffering from empyema of the right pleura was sent to Lister from the medical house. The chest had already been aspirated four times. Lister opened the pleural cavity by incision and evacuated eighty ounces of pus, which fortunately had not been infected by the aspirations. A rubber drainage tube was inserted and a gauze dressing applied. For some weeks everything went well, then one day, while Lister was from home at Christmas, the man informed me that the fluid was again accumulating. As percussion showed that his surmise was correct, I took off the dressing, and found what I expected; the drainage tube was not functioning, having been occluded by pressure of the ribs. I, therefore, removed it, replacing it by a tracheotomy tube; then there flowed out thirty-five ounces, not of pus, but of clear straw-coloured serum.

On Lister's return I told him what had occurred; it greatly pleased him, as it was a remarkable confirmation of his teaching as to the reproduction of pus in empyema, psoas and lumbar abscesses, either aspirated without being infected or opened without being effectively drained. He thought that the serum came from the vessels of the pleura when left unsupported by the withdrawal of the contents of the cavity, but it was not until tension was re-established that pus was reproduced. How much he would have liked

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to have seen what I had observed may be judged from the remark he made to me, "Mr Baldwin, you have seen what no man has ever beheld before." It never entered his mind to reproduce the clinical picture, which could so easily have been done, nor would I have liked to have been the one to suggest such a course to him.

In 1877, Lister went to London, carrying with him the great revelation that he was so anxious the surgical world should receive, and which, if accepted, he knew would cause a beneficent revolution in both the science and art of surgery all the world over. History now records that his great principles accomplished what he expected of them.

Let me add a few words concerning Lord Lister's life and work viewed as a whole; his true place, not only amongst the men of his own day, but amongst all men; what he has done for the science to which he devoted his life's work; and lastly, the place that should be accorded him in the esteem and love of his fellow-men.

Lister was one of a class whose members are but few, even in the grand aggregate. At long intervals they appear, but all have one distinguishing characteristic; a vision that enables them to perceive and understand what others only see; and what they see is usually, if not indeed always, some great principle or force operative throughout all Nature at all times. Such a man was Newton, who, by his recognition of the part played by gravity, read the riddle of the universe in one aspect at least. Another was Watt, who saw the secret of development of controllable, and therefore of usable power, that lay in the production of pressure. And then, Lister, who recognised the cause of putrefactive changes in wounds from the introduction into them of microbic life, giving rise to more or less systemic disturbances and very frequently to death. He was enabled to

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abolish that dread family of diseases by preventing the germs attaining access to surgical wounds, and by extirpating them from traumatic ones, when seen sufficiently early to do so.

Lister, while a distinguished surgeon, was a man of great and varied attainments; we frequently heard him spoken of as "that eminent pathologist," and as an accomplished physiologist. He was no mean chemist, and pursued botany as the science of his recreation. But the secret of his greatness lay in the fact that, above all, he was a philosopher. With him, to observe a phenomenon, was to seek its cause; to see a need, to seek to supply it; and with untiring energy and ceaseless effort not to be satisfied until the problem had been solved. And so, I venture to think and hope, that he will one day come to be known as the great Surgeon Philosopher, the greatest the world has ever known.

If we would epitomise his work for surgery, we do not transcend the truth, I think, when we say that he has rendered possible the performance of any operation not incompatible with life. In accomplishing this, he has enabled surgery to make the greatest advance it has ever made towards that goal to which it should ever be the aim of its professors to advance it—the making of surgery an exact science and a perfect art.

If we judge Lord Lister's life and work from the viewpoint of humanity as a whole, his record is unique. If we apply to him the rule which He who united in Himself both Deity and Humanity formulated, and whose words and principles are always true in every relation in which they are capable of being fairly applied, then by this standard Lord Lister will not be found wanting, for, in a very true sense, he has been the servant of all, and therefore worthy of being acclaimed Chief by all.

E. St G. BALDWIN,
Clerk, 1872-73; House Surgeon, 1875-76.

III

WHEN my course as a student in Edinburgh was completed, two of the last cases which I attended as a clerk, a psoas abscess and a large chronic hip abscess, were patients who had specially interested me. The abscesses had been opened and drained; the patients then developed fever and profuse suppuration, and died.

Hearing that Professor Lister was "curing similar cases with carbolic acid," I visited his wards. He received me with gracious kindness, and showed me a woman, aged between 40 and 50, admitted with a large, chronic psoas abscess which he had opened and drained three months previously. This, he explained, he dared not have done without full confidence that "putrefaction" in the abscess sac could be prevented by the methods he had adopted. The patient looked well and was fat and cheerful (she completely recovered in one year) and the dressing, applied three days before, showed only a small, odourless, serous stain.

I asked to be allowed to work in his wards, and, in the summer of 1873, was appointed special clerk. Later, I dined in his home, and, dinner being finished, he invited me to see the room in which he worked. Mrs Lister accompanied us, and was enthusiastic and well informed in regard to every detail. The number and ingenuity of the experiments overwhelmed me.

It is difficult for surgeons at the present day to understand the conditions at that time. A strong girl, 18 years of age, who had a hammer-toe amputated, and a healthy man with

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a brachial aneurysmal varix skilfully operated upon, died from septicæmia within ten days of the operation. This impressed me. Few cases healed without fever and suppuration. Pyæmia developed at recurring intervals, at times so serious that the surgeons closed their wards, fumigated them, limed the walls and ceilings, burned the mattresses, steamed the clothing and kept the wards vacant for a month.

Lister claimed that these were preventable troubles, that wound fever, suppuration, and all the complications which made surgery a terror were due to wound infection by germs, derived from the air, the hands of the operator, the skin of the patient, from dirty contacts, instruments and dressings; that success depended upon attention to every detail of this knowledge; that operation wounds in clean tissues should heal without constitutional disturbance; and that accidental wounds treated early and thoroughly by antiseptics should do the same.

At that time he dressed all the serious cases himself. He tolerated no excuse for failure; in the latter event a reason must be found to guide future developments.

Chloroform administered by a dresser on a specially folded towel, the Professor being responsible, was the only anæsthetic.

All dressings and operations were performed under carbolic spray, and a watery solution of carbolic acid (1 in 20) was used for the hands of the surgeon and those of his assistants; for the skin of the patient, the instruments and sponges.

One or more large drainage tubes were placed in every wound, catgut ligatures and silk soaked in 1 in 20 carbolic lotion secured the blood-vessels and closed the incision. A strip of green protective dipped in carbolic lotion covered the wound to prevent irritation from the antiseptic in the dressings; over this was placed a pad of carbolic gauze

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wrung out of carbolic lotion to inhibit germs on the dry carbolic gauze; and covering all was a large dressing of eight layers of carbolic gauze, with a sheet of jaconet between the seventh and eighth layers to prevent blood or discharge from coming directly through the dressing. A bandage of the same gauze, sufficiently adhesive to prevent it slipping, and safety-pins, completed the dressing.

Dressings were changed at once if blood or discharge came through. If not, they might be left for two or three days. During the time of my service only one operation wound suppurated. The patient, a man, had had part of his scapula excised for sarcoma. At the operation the spray broke down, and this explained the failure.

Granulating wounds, after sepsis had been arrested, were dressed with protective and boric lint.

My chief, Heron Watson, was the most popular surgeon of the day in Scotland, and his reputation was based upon his diagnostic skill and his brilliant and pioneering operations. Anæsthetics had not yet abolished the outstanding value attached to speed and dexterity in operating, but Lister introduced a new era. Compared with Heron Watson his operations were slow, but never poor as has been said. Lister performed original operations. Every step was fully considered and his intentions were thoroughly and skilfully carried out. When I was his clerk, major operations were rare; his devoted enthusiasm was concentrated upon practical means of preventing and defeating the causes of wound infection.

A German surgeon visited the Royal Infirmary to learn antiseptic methods. He could speak no English and Lister only a few words of German; a year later I heard Lord Lister speaking German well. The visitor was obviously profoundly impressed when a compound fracture, three weeks

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old, uniting under blood clot, an ulcer healing without pus formation, and the psoas abscess previously mentioned, without constitutional disturbance or suppuration, were demonstrated to him.

Henley, the poet, was a patient in Lister's ward during my service, and I occasionally dressed his wounds. His name is immortal, if only for the strikingly accurate word picture he has left of 'the Chief.'

Is it any wonder that his followers regarded Lister as an inspired genius?

Later visits to Edinburgh and London always revealed to me some modification in detail of Lister's technique, but never in the principles of treatment, till, in 1887, the spray was abandoned. He then said it might be safe to ignore atmospheric organisms, and in any case the spray was not sufficient security against them.

Nobody doubts the presence of atmospheric germs, but it surprised me to find how numerous they were in the operating theatres where I worked.

Present fashion in surgery dictates a dry technique and I followed it until two surgical calamities (gas gangrene) pulled me up. Both occurred in clean cases, months apart, in different hospitals. Our sterilising machinery was of proved efficiency, nothing but instruments entered either wound, and both patients died within three days. In thousands of operations performed on antiseptic lines, I had never had such an experience. The calamities occurred in the 300 to 500 cases in which the dry method was practised.

If similar disasters have arisen in the hands of other surgeons, they will surely be driven to employ a technique more fully satisfying Lister's requirements.

RUTHERFORD MORISON,
Special Clerk, 1873.

IV

I FIRST saw Lister and made his acquaintance in Edinburgh during the Winter Session 1872-73, and I was closely associated with him from that time until he had to give up work and retire to the country early in the present century.

During my second year of medical study in Edinburgh I had an interval of an hour between lectures. As there was no Student's Club in those days, I took out my hospital ticket so as to have shelter while waiting for my next class. On the day of my first visit to the Infirmary I found my way by accident into Lister's lecture-room and although I knew no surgery, he spoke so clearly and plainly that my enthusiasm was at once aroused. On Lister's lecture days, as soon as I returned home, I made a point of writing out my notes and recollections of what he had said in a book bought specially for the purpose; this book is among the Lister records at the Royal College of Surgeons of England.

How different were the lectures and demonstrations given by Lister from those in the systematic course of surgery which I was attending at the same time! The latter were full of curious theories almost impossible to understand and very difficult to memorise, while Lister's words at once held the attention of the student by reason of the new and intelligible statement of the subject. Like the majority of the students, I was fascinated by the subject and by the lecturer, and often of an evening, when tired with other work, I would take up my note book and dream of the wonderful future which was opening up for surgery.

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And now I may relate what came of this early and accidental course. I have never told the incident as it seemed to savour of bragging, but it is interesting and curious as showing how an apparently trivial occurrence may shape the whole course of one's life. In those days in Edinburgh, class examinations which all students were expected to attend were held from time to time. In the Winter Session there were generally two of these, and at the end of the period the list of those who obtained above 50 per cent. of the marks was announced in order of merit, and bronze medals were given to the first two or three men, according to the number of students who competed. Being a very junior student I had not intended to compete in the clinical surgery class, because it was attended only by fourth or fifth year students. When the time came, however, it struck me that I might as well sit for the examinations so as to see what kind of questions were asked, and in this way perhaps obtain a good place in my fourth year.

When I read the questions I could recall vividly my notes as if I had had the note book at my side. To my great astonishment and that of the other students, at the end of the session my name was read out first with 93 per cent. of marks. Lister made it a rule to present a prize to the man who came out first, and the prize was always a case of silver catheters. After an interview with me, at which he presented the catheters, he offered me an appointment as dresser during the summer. This was followed by a clerkship during the winter, his House Surgery at Edinburgh in 1876-77, and a similar post, in 1877-78, at King's College Hospital. Subsequently I became one of his private assistants, the other being his nephew, the late Sir Rickman Godlee. It was a wonderful time, and we three worked together with the greatest

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interest and unanimity till, at last, the time came when Lister gave up private and hospital practice.

I often marvel at the inspiration which caused me to attend Lister's clinical lectures in the winter of 1872-73, and at the extraordinary good fortune which led me, a shy, uncouth youth without any influence or money, to become intimately associated with one of the greatest men who has ever lived; with one who entirely revolutionised surgery, and who has done more for the relief of suffering and for the saving of life than anyone else. With it all he was a man of extreme modesty, full of generosity and sympathy with the afflicted. Truly he was a man without guile and venerated by all who were closely associated with him. I think that most of those who were intimately acquainted with him had a feeling of awe in his presence; for my own part I never lost it. He seemed so far above us, and he had achieved such a wonderful revolution in surgery.

It is curious how events and discoveries fit into their proper place in the history of the world, and how one discovery may often dovetail into another and increase the usefulness of both. I have in my mind, at the moment, the discovery of anæsthesia and asepsis.

Anæsthesia alone was naturally a very great gain to mankind both in saving pain and in reducing shock, but in some respects it was a disadvantage. Before its introduction, the hall-marks of a good surgeon were rapidity in operating and thorough anatomical knowledge. The range of operative work, however, was not very great. But the fact that pain could be abolished and shock considerably reduced by anæsthetics had the effect of encouraging surgeons to perform more prolonged and intricate operations. The consequence was that, as sepsis was as frequent and as dangerous as before, this meant an increase in the number

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of cases of sepsis and in the mortality in the surgical wards ; and surgeons became more doubtful than ever of the advisability of extending the area of surgery.

As soon, however, as Lister had firmly established his aseptic methods, this difficulty passed away ; rapid and enormous extensions of the limits of surgery were introduced by him and his followers, and anæsthesia took a permanent and most important place in forwarding this.

The times were indeed ripe for the revolution made by Lister in the treatment of wounds. For ages, those who practised surgery were constantly confronted by the various septic diseases following wounds, whether made accidentally or by the surgeon. Occasionally, some one had a glimpse of the truth, but the wound treatment, whatever its nature was, had as its object the application of dressings and medicaments in order to make the flesh heal, as opposed to Lister's principle of leaving the wound itself alone while striving to remove all agencies which might hinder the wound from healing.

The cause of the septic troubles was for long looked on as connected with the admission of air to the wounds, and when oxygen was discovered, that gas was generally blamed for setting up changes in the blood and tissues. But towards the end of the eighteenth century, John Hunter pointed out that it could not be the gases in the air which caused harm, for in cases of emphysema and pneumothorax due to fracture of a rib and puncture of the lung, the tissues and the pleural cavity became distended with air ; but neither sepsis nor suppuration supervened. Hunter, therefore, was in favour of abolishing the masses of dressings which were most in vogue in those days, and contented himself with applying a piece of dry lint over the line of incision and encouraging drying of the lymph and blood—that is to say, healing by

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scabbing. His example was followed by others, who tried to aid scabbing still further by blowing warm air over the wound at frequent intervals, or by the use of powders, dusting the line of incision with them.

About the same time Abernethy advocated with considerable success the use of valvular incisions in removing loose bodies from joints and in opening psoas abscesses.

At the beginning of last century, subcutaneous surgery was introduced and Delpech elaborated it. Although its range of action was comparatively small, it still remains one of the important surgical methods of the day.

During last century, a number of methods of treating wounds were introduced with a certain amount of improvement in results. Such methods were, open treatment, water dressing, immersion, water bath, irrigation, occlusion, etc. Just before Lister began his work, various substances, chiefly in solution, which belong to the class of antiseptics, *e.g.*, coal tar, carbolic acid, iodine, hypochlorites, perchloride of iron, etc., were being tried, especially in France. Of these, carbolic acid was lauded by Lemaire, but these antiseptics were only used in septic wounds; and Lemaire and others missed Lister's great generalisations which were the basis of his work.

I may mention here Lister's slogans, to use a word which has gained recently much prominence.

1. "Destroy the bacteria before they enter and establish themselves in the tissues."

2. "Antiseptics are not used as applications to the tissues of the body laid open by the surgeon, but to the bacteria which are present everywhere, in the air and on the objects around."

3. "Let as little as possible of the antiseptic enter the wound, but do not be unnecessarily afraid of it because,

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so long as the bacteria are kept out, any superficial damage done by the antiseptic will be rapidly repaired without any acute inflammation or suppuration."

4. "The failure of the previous attempts with antiseptics was due to the fact that they were applied to wounds to which bacteria had already gained access and, as there is very little chance of eradicating the bacteria at that stage, irritating antiseptics like carbolic acid only make matters worse."

One would have thought that these principles were clear, and when taken along with the published results would have been very convincing. It was always a great puzzle to Lister's staff that surgeons did not rush to his clinic to see the results and to learn his technique. True, there were usually some foreigners, chiefly Germans and others of the Scandinavian races present in Edinburgh, but the number of British surgeons was very small indeed. Thus, when Lister migrated to London, in 1877 (ten years after his first publication), the number of London surgeons who were using his methods or were impressed by his teaching was extremely small and could probably be counted on the fingers.

It is not easy to account for this state of matters. Among other things it was very difficult to convince surgeons that tiny pieces of protoplasm about $\frac{1}{20,000}$ in diameter could be the cause of the septic diseases; the surgeons of that day were interested in keeping up their anatomy and in acquiring great rapidity in operating, and minute germs and processes of fermentation seemed very far removed from practical work; moreover, before Lister's time, carbolic acid and other chemicals had been applied to wounds without any benefit.

Lister's statements as to what he had achieved were so contrary to the experience of other surgeons that they felt

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that there must be a fallacy somewhere, and they were quite sure that the fault did not lie with them. They noted that Lister was constantly changing his technique and dressings, and came to the conclusion that this was because his results were not good. They apparently did not listen to his statements, that he did so with the object of reducing or removing the irritation of the antiseptic and, at the same time, simplifying his technique. They also pointed out that primary union of wounds was not a very uncommon occurrence before Lister's time, but they ignored his statement that it was the rule in his wards; they further pointed out and greatly magnified the disagreeable effects of carbolic acid on the hands of the surgeon and its occasional poisonous effects.

In spite, however, of these and other objections which need not be recalled, Lister went on with his work. When he retired there was little fault to find as regards irritation of the wounds or skin by the antiseptics, and sepsis had become a matter of the rarest occurrence when his methods were rigidly adhered to. He always held that, if failure occurred, the fault lay with the technique employed by the surgeon and must be sought in the method adopted.

W. WATSON CHEYNE, Bt.,
Dresser and Clerk, 1873-74; House Surgeon, 1876-78.

THE 8th November, 1869, is a memorable date in the history of the Edinburgh School of Medicine.

Mr Syme had retired from the Chair of Clinical Surgery, and Mr Joseph Lister had been appointed his successor. Rumours of a new and strange system of surgical treatment had preceded him and spread through the student world. On that day a large audience, mainly composed of medical students, many of the first year of whom I was one, gathered in the Chemistry class-room of the University to hear and to see its originator and protagonist.

The scene was an unforgettable one. Rows of eager and expectant students occupied the usual seats. On the table in front of the platform, instead of surgical apparatus, a variety of flasks was arranged, some with long, narrow, twisted necks, some with short necks stuffed with cotton wool. These preparations were more consistent with the usual chemistry lecture than with that of surgery. The Professor entered, giving in some mysterious way the impression of the philosopher rather than of the practical surgeon, but with him, so far as I can remember, were none of the senior members of the surgical profession, with the notable exception of Mr Syme.

The lecture was chiefly devoted to an exposition of the germ theory of putrefaction and fermentation, the principle on which the new treatment was based; and the demonstration of its truth was, to the unbiassed mind, as clear as it was masterly. The closing words were an earnest appeal to the students to accept the truth without delay, as they were then as capable of understanding it as they

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would be in later years ; this was coupled with a warning of the fateful consequences of rejecting it.

And what of the lecturer? The large and well-built frame, the fine face, the gracious manner and the beautiful voice, no less than the brilliant clearness and simplicity of the lecture itself, made an indelible impression. Nevertheless, the force of various circumstances led me, during my early years of study, to attach myself to the old school of surgery. This I have never regretted as it gave me an opportunity of comparing the old with the new in a way alike convincing and dramatic ; and to have been an eye-witness of the transition was a great experience. Along with much that was good, the former is ever associated in my memory with a mawkish odour in ward and corridor, with acute suffering, with septicæmia, erysipelas, hospital gangrene, and a haunting dread of the next rigor ; tragedies conspicuous by their absence in Lister's wards.

From time to time I stole away to the "antiseptic quarters." On one occasion I was peculiarly fortunate to find Mr Syme looking on at the handling of a compound fracture of the thigh, just admitted, and expressing wonder and admiration as Lister massaged the carbolic lotion into all the interstices of the lacerated wound, confidently predicting a favourable result.

As time passed, attendance at the clinical lectures became necessary. The individual cases are well-nigh forgotten, but the impression made of a high scientific and philosophic atmosphere, associated with the quiet but intense enthusiasm with which Lister discoursed on such subjects as blood and blood-clot, cannot fade from memory.

It was a descent to mother earth and an interesting sidelight on his moral nature to find him taking the attendance cards himself at the close of lecture.

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He examined me in clinical surgery at the Final Examination and asked me to mark on a patient's thigh the incision for tying the femoral artery. We differed, and I held to my view, based on what I had been taught elsewhere. The gentle courtesy with which he replied that he but reflected the teaching of Mr Syme, captured me for all time.

On an evening in August 1874, I was told by Lister's assistant, Dr John Bishop, that the House-Surgeonship for the coming winter session had unexpectedly fallen vacant. With unconscious audacity I called on Lister next morning and applied for the coveted post. He gave it to me with the proviso that I should previously act as clerk with him for two months, as I had never worked in his wards. It was a legitimate grievance with him that a house-surgeon, even although previously trained by him, could hold the appointment only for six months; this necessarily meant more or less inexperienced help in carrying out treatment which had no traditions and which was by no means static.

Lister saw the full bearing of the germ theory of putrefaction and fermentation on the behaviour of wounds in relation to healing and septic poisoning. The problem presented to him was the application of the theory to practice, and the opportunity I had of witnessing a part of the struggle has now convinced me that few realise its Titanic nature. As he confessed to me, the difficulties and disappointments were agonising. Now, all seems so simple. The surgeons of to-day little reckon how much they owe to the man who with magnificent scientific acumen brought all his knowledge of chemistry, natural science, biology, physiology and pathology to bear, with "faultless patience and splendid skill," on the complexities of the problem, so that, by 1874, many difficulties of technique had been overcome and unchallengeable results were being obtained.

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It may be a question whether the application of the theory was not a finer thing than its conception. The application was certainly much more difficult. The brilliant idea had occurred to others. Only one man had arisen who could carry it on to fruition.

An interesting part of my experience were the visits of young continental surgeons, sent by their "chiefs" to learn the new methods. They cared for nothing but his teaching. It was an obvious delight to Lister to welcome these searchers of truth, sent by those who could understand and appreciate his work. I remember well the quiet satisfaction with which he remarked to me that for the first time in their lives they had seen "healing without cicatrization." Such appreciation encouraged him greatly in view of the critical and even hostile attitude of his compeers at home, an attitude which he keenly felt.

He came to hospital in his carriage, but after his long visit he walked home. He was fond of knowing Scots words and as I accompanied him to the upper exit, a little distance from his wards, he received some tutoring in their pronunciation and I had cherished opportunities of conversation.

Two abiding impressions remain ; the inestimable privilege of being in the forefront of surgical science while with him, and the memory of the nobility of his nature, as shown in his generous appreciation of anything well done. A gentle word of reproach or a transient look of sadness alone indicated his feelings when confronted with the failure or shortcomings of others.

"Let not mercy and truth forsake thee ; bind them about thy neck," were his closing words to his class at the end of a session. In him they were notably exemplified.

T. R. RONALDSON,
Clerk, 1874 ; House Surgeon, 1874-75.

VI

THE question of "Spontaneous Generation" and the "Germ Theory" had aroused general public interest after the delivery of Huxley's address, in 1870, at the meeting of the British Association. As the practical outcome of scientific researches on the subjects at issue, he instanced the valuable work of Pasteur, and emphasised "the very striking facts adduced by Professor Lister in his various well-known publications on the Antiseptic Methods of Treatment." "It seems to me impossible," said Huxley, "to rise from the perusal of these publications without a strong conviction that the lamentable mortality which so often dogs the footsteps of the most skilful operator, and those deadly consequences of wounds and injuries which seem to haunt the very walls of great hospitals . . . are due to the importation of minute organisms into wounds, and their increase and multiplication."

At the close of the summer of 1872, I happened to be employed in the Botanical Department of the University of Edinburgh, when a handsome gentleman, of fine stature with a gracious smile, entered the retiring room to leave a specimen of *Peziza Coccinea* which he had recently collected when on holiday. "That must have been Lister," said Professor Balfour, as he later admired the specimen so remarkable for size and beauty.

The youthful desire to see more of this famous scientist, who had so greatly attracted me, was speedily gratified; for on Professor Balfour's recommendation I was entrusted to enlarge to diagram size Lister's Camera Lucida drawings for

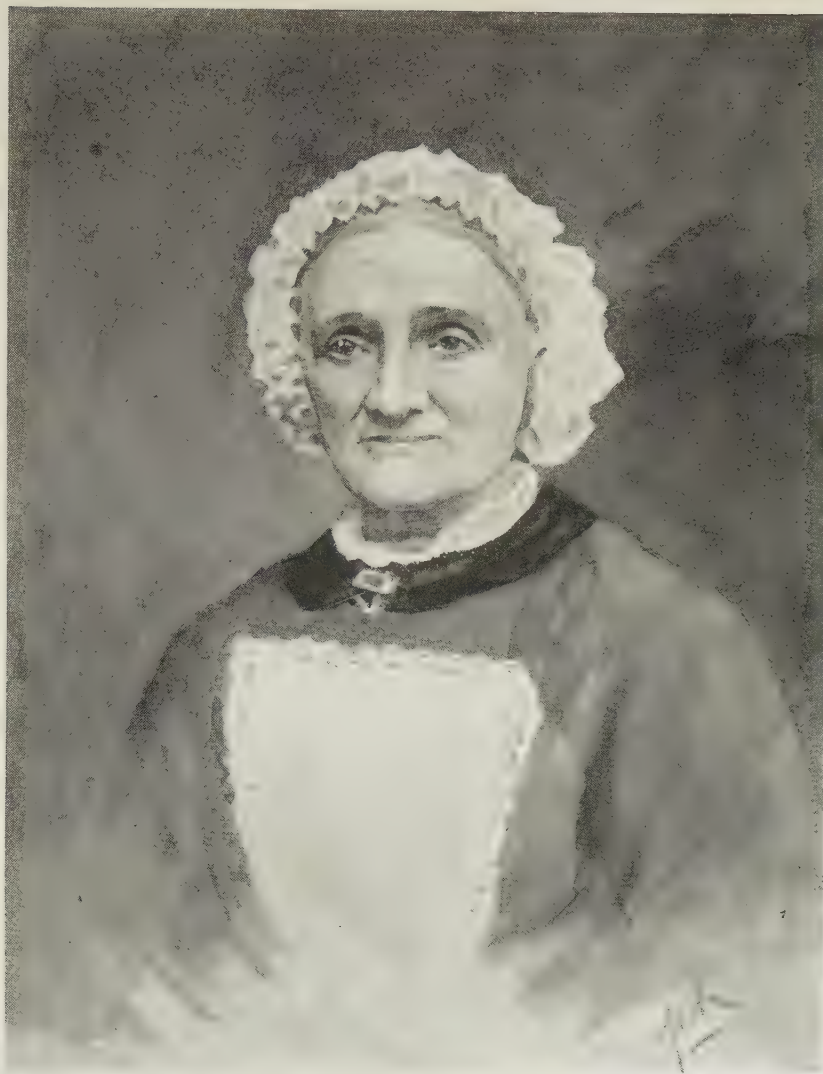
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the illustration of his address in the following April before the Royal Society of Edinburgh.

The diagrams were completed at his house after dinner, when the huge scrolls were spread out on the carpet and with the aid of a Liston's long splint, used as a ruler, the lettering was effected. These few happy evenings were sometimes prolonged till midnight, when Mrs Lister, interested in the proceedings, would enter with sherry and biscuits. Mr Lister's animation throughout, his pleasure in showing an etching by Seymour Haydon which hung above his desk, his joy in demonstrating the various coloured organisms which he had isolated from milk, his pride in surgery as the ideal profession, all proved incentives and indeed determined my future.

It was customary at that period for students to begin their hospital work while they were yet busy in the dissecting-room, even prior to passing their First Professional Examination. Moreover, many of us already attended lectures on systematic surgery in the Extra-mural School; those given by the kindly and dexterous Joseph Bell, or by John Chiene whose earnest and clear teaching was greatly in request. We usually served as hospital dressers in the wards of one of the junior surgeons before aspiring to a similar position under Lister. The tide of reform had as yet produced no marked effect, for we were dismayed by the unpleasant odour of the wards despite the numerous bowls of Condy's Fluid, the roaring fires and the open windows. The temperature chart recorded leaps and bounds, the dressings were painful and frequent, pyæmia claimed many victims. Relays of dressers sat up by night, watching cases of amputation for fear of secondary hæmorrhage.

Great was the contrast on proceeding to Lister's wards. Gone was the vicious atmosphere. The temperature charts



JANET PORTER.

Died 10th February 1890, aged 80, after 47 years of exemplary service as Nurse in the Royal Infirmary of Edinburgh. From the portrait presented to the Royal Infirmary, in loving memory of their old friend, by the Members of the Nursing Staff who were associated with Mrs Porter during the years of her noble work.

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showed an almost level line, pain was practically unknown, dressings were undisturbed for days, and a fatal issue rare. It was a new world, where unheard-of operations, generally thought to be unwarrantable, were carried out with boldness and safety.

Lister was at that time absent on leave making his triumphal progress through mid-Europe and, fortunately for us, Chiene had been appointed in his place, teaching with unsparing energy and expounding the Principles of Surgery with rare devotion.

We frequented the wards assiduously during all spare hours by day and night. Many spent much of their vacation recess in hospital. We discussed and debated even in the dissecting-rooms, for feeling ran high, nor was our enthusiasm disheartened, nor were our spirits damped on being told that we were "following a vain show" and that there "were great men before Agamemnon"; for we saw history in the making. Strong were the bonds of friendship forged amongst the zealous band that embraced John Stewart, Edward Hoernle, Berry Hart, Sims Woodhead, Henry Briggs, and many others who united in hero-worship of their Chief, and of the resident surgeons under whom they wrought: Ronaldson, Rice, Watson Cheyne, and their successors.

One recalls with affection the somewhat gaunt, bare yellow walls of the wards so enlivened by surgical triumph and the abolition of pain. One sees again the worthy nurse, Mrs Porter, making her nightly round, candlestick in hand, towel over arm, bearing a tray of requirements, as she called, "Wha' says ile, wha' says peels?" One can hear her accounts of the old days when the head nurses sat at the dinner table on which was deposited the pot of boiled potatoes, from which each helped herself with the hand. Of the new régime with its flock of probationers and

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examination system she was highly sceptical, and, on being congratulated that those under her own training took a high place, remarked, "Bonny-like probationers that canna' mak' a bed!"

Her Lister worship was intense, yet she would attempt her authority, dog his footsteps and, as he approached the stairhead on his way to the wards downstairs, would gently filch the towel from his hand saying, "Excuse me, Mr Lister, but gin' my towels gang doon below, they ne'er come up again." Thorough and good-hearted, many were the kindnesses she showed to poor patients who would find, on the morning of their discharge, small sums of money under their candlesticks to help them on their way home.

The tears ran down her cheeks when Lister went to London. In later years, in her little room which was tapestried with photographs of former residents and others, she found herself ever surrounded by old friends, and as she indicated her air cushion would say, "An' I'm sitting on Dr Ronaldson." She would sigh as she remarked, "We've nae Listers or Symes noo, but we try our little best." She never lost interest in her work, and in advanced age sallied forth to remonstrate against a necessary disarticulation at the hip-joint after a railway accident, crying, "Leave him alane my laddie, Mr Syme wouldna' hae touched him."

Mr Lister duly returned invigorated by the ovation which he had received in Munich and elsewhere. As he recounted his experiences we felt certain that the battle was won, the fulfilment of his prophetic words in 1869: "The universal adoption of the antiseptic system, whether in the form which it has now received, or whether in some other and more perfect shape, can only be a question of time."

Lister's heart must have rejoiced to meet such a band of ardent followers. He had implicit confidence in his

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staff. To his clerks was entrusted the sole charge of giving chloroform. Only once have I seen a graduate undertaking that duty in the theatre; it was an anxious case of goitre. The clerks were also invited to undertake the same responsibility in his private practice, as well as to assist at operations.

The prolonged Sunday afternoon ward visit proved a great attraction. While waiting for Lister's arrival, the staff and students had a valued opportunity of exchanging views with the many eager inquirers, visitors from the Continent and America, whose initial critical remarks after a few days' sojourn ended in admiration and a contagious enthusiasm for all they had observed and learned. Amusing were the linguistic difficulties when schoolboy French would explain "*Voilà une excision du elbow-joint, Monsieur,*" or, "*C'est la lotion, one to twenty Carbolique*"; till some fluent nurse was called to the rescue, or the Chief himself, apparently polyglot, appeared on the scene. These were great times!

Lister's commanding personality, his expressive sympathetic eyes, that yet could flash with scorn and indignation; his tenderness and gentleness that won the affection of every child; his intense earnestness and love of truth appealed to everyone who came near him. He revered the names of John Hunter and Mr Syme. He would dwell upon the lessons he had received from his old teachers; he never omitted an opportunity of making graceful reference to the associations he had formed in Glasgow. He dealt logically and generously with his opponents, and ignored personal attacks. On one occasion when a colleague had unfortunately failed to achieve success in an operation then regarded as rather bold and hazardous, which some surgeons did not hesitate to condemn, Lister staggered his class by stating that he was about to carry out a similar procedure, encouraged

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thereto by the skill and thought displayed in the operation he had just witnessed.

Keen to establish right and to sweep away error, he was equally ready to acknowledge his own mistakes, and to recall any of his own opinions which had turned out to be fallacious. He thought out and foresaw all difficulties before he ventured on any fresh operative problem.

Lister's clinical lectures were an intellectual treat. Abounding in original matter, couched in choice English, they made a strong appeal to the individual observation, thought and judgment of his hearers. His "Why is this?" aroused the attention of all. There was a frank acknowledgment of ignorance in his "We do not know," as he advised the use of remedies whose mode of action was not yet understood.

From fifty to sixty cases were demonstrated each winter session, and again introduced to illustrate progress and result. The specimens from operations were shown and studied, and a never failing autopsy awaited the very rare fatalities.

The work was interpolated throughout by a combined series of lectures on the subjects which Lister had made specially his own—inflammation, the blood, micro-organisms and their isolation together with observations on the anatomy of the bladder in connection with the high and low operations of lithotomy, chloroform, amputations, and so on.

While he dealt boldly with hernia, effecting radical cures, excising and forming end-to-end unions for gangrenous bowel, he deliberately refrained from invading the abdominal cavity lest he should dangerously affect its contents by the irritation of antiseptics and the cooling influence of the spray. He preferred to relegate such cases to his friend, Dr Thomas Keith, with whose brilliant results he was entranced. Still, he expressed a confident belief that the new generation would yet master the peritoneum and its contents.

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Beyond the cure and alleviation of suffering, there ran through every discourse the principles of antiseptic surgery as the *leit motif*, as constituting the basis of all success and progress. He insisted that all who were imbued with a thorough grasp of these could not fail to carry out the desired object, however scanty might be the available means. He emphasised the safety of his system, as he indicated the value of a warranted exploratory incision in obscure cases, and the knowledge to be acquired from a study of living pathology.

Lister delighted to expatiate on the contrast between the anxious history of a compound fracture and that of one with unbroken skin. He contrasted similarly the result of the rupture of a cold spinal abscess with its progress when evacuated and drained under antiseptic precaution. He drove the lesson home by reference to emphysema resulting from the simple fracture of a rib in contrast with what occurs when it is due to an open wound. He defined clearly the preventive aspects of his system, and demonstrated its curative possibilities by the early purification of compound fractures and open wounds.

The criterion of success in the wards was the avoidance of putrefaction and fermentation in a wound. This was recognised by the absence of fœtor, inflammation, pus formation, and living bacteria in the discharge.

When we look back on the Old Royal Infirmary, its large lecture amphitheatre used for operations, thronged with students who had come from the dissecting and post-mortem rooms, staffed by students in old coats—for nurses were but rarely admitted—who acted as bearers and attended to sponges and instruments, one is lost in admiration of the universal excellence attained, of results which at the present day are perhaps not equalled in the treatment of open

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wounds and compound fracture. Septicæmia was banished and tetanus unknown, but it was not till a later date that sterilisation by heat removed all limits to the scope of surgical intervention.

Lister's progressive unrest often perplexed his disciples, as he modified methods in treatment. Even then he regarded the spray as unessential. Many there were who failed to comprehend his teaching. One was struck with this on visiting some schools both at home and abroad; one might see septic excisions of the knee-joint pouring forth pus, yet dressed with scrupulous pedantry under the spray; or admire an amputation of the thigh performed with meticulous attention to antiseptic detail, yet rubbed with an ordinary towel from the rack, before application of the dressing. Again, the operator might have a supply of catgut hanging for convenience from the buttonhole of his coat—and such a coat!

The expense of the dressing materials, the poor and irritating qualities of the cheap carbolic acid supplied, the imperfect and hastily prepared catgut, all militated against, but could not check progress, and paved the way for improvements which Lister did not hesitate to adopt when they seemed to him beneficial.

Lister was a neat-handed operator, whose one thought was for the patient. He was thorough and never hurried, save in emergencies when rapidity was necessary, and then he shone.

It was a bitter day for Edinburgh when the great teacher, so fervent in spirit, said farewell to the Old Infirmary.

FRANCIS M. CAIRD,
Dresser and Clerk, 1874-77.

VII

TO write an appreciation of Lister is a difficult task. Although a generation has passed since the world acclaimed him as a great benefactor, we are perhaps still too near to appreciate his figure in its true perspective.

Our love, our loyalty and our reverence for him, call us to proclaim our estimate. We do not hold with the dictum that genius is merely the capacity for taking pains, but if this gift were the pass to the hierarchy of genius, then assuredly it would admit Lister, because his capacity for taking pains was almost incredible. The same quality of thought and closeness of attention which were brought to bear on the weighty and sometimes appalling problems of surgery were bestowed on the smallest details, even to the proper fastening of a safety-pin in a dressing. His constant study of the infinitely little may have strengthened his conscientious care of what, to many, seemed trifles. But there was much more than tireless and laborious exactitude. In the planning of his experiments and in his interpretation of results we have to admit the presence of that indefinable quality of intuition, the prescient eye, the inward light, which mark the man of genius.

Perhaps the outstanding feature of Lister's character was his humanity. He was not led to his epoch-making work by purely intellectual aims or a natural love of investigation, but he was prompted to it by his deep sympathy with suffering and his innate kindness of heart. This tenderness

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was noticeable in his dealings with his hospital patients, and did not escape the sharp eye of a street arab in the Royal Infirmary, whom he heard say, "He likes the little yins best, and the auld women."

He had no taint of selfishness. His reiterated acknowledgments of his debt to his friend Pasteur are well known. We remember the eager enthusiasm with which he told us of Koch's brilliant idea of solid culture media.

In the early years of his work in antiseptic surgery his sensitive spirit was often wounded by the apathy, the opposition, the misrepresentation with which his views were met. But even when opponents descended to unworthy insinuation he replied with dignity and without resentment.

Nothing was more impressive in the character of this truly great man than his simple, unaffected modesty. He was the acknowledged master in his own domain, but he was open to suggestion and to criticism. It would be a hard thing for most men to give up a method developed at great cost of time and labour, with which their names were associated, and which, in the view of many, had made them famous. But when Lister became convinced that the advance of science had proved that the carbolic spray was unnecessary, he was one of the first to give u its use.

The world owes much to Pasteur, more than to any man before him. Without Pasteur, Lister's work had not been. But it was Lister who applied the knowledge directly to the service of man. Pasteur's researches on fermentation, on anthrax, on pebrine, were of invaluable assistance to the vineyards, the flocks and the silk industry of France. But life is more than meat and the body than raiment, and we think Pasteur's supreme merit lies in having equipped Lister.

If we were to say Pasteur had forged the sword with

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which Lister conquered, we fear our figure of speech might have brought a gently reproving smile from him who owed so much of the charm and strength of his character to the Society of Friends. Let us say rather that Pasteur gave Lister the key to unlock the iron door. This key was the germ theory. But even with the key, the work was hard, for the combination of the lock had to be learned.

The influence of Lister's personality on his pupils was very great. It is difficult to express it in words. There are men all over the world to-day who consider it their highest honour to have been pupils of Lister, and to have worked with him, who comfort themselves in dark days with the thought that they realised they were in contact with genius, and that their prophetic souls saw the new era dawning.

None of us who experienced this magic touch, who felt the stimulus of that great, earnest, beneficent spirit, can think of it as something lost ; the thought of him, and what he was, gives an impression of perpetuity, and forbids us to believe that death ends all.

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As a teacher Lister was peerless. His earnestness, enthusiasm and energy were contagious, and inspired "such love and faith as failures cannot quell." He made it his business to define and expound principles. His teaching at the bedside was invariably interesting and practical, and it had then all the novelty of a new-found world. His lectures were models of English speech in clearness and simplicity, and the musical voice in which he spoke made them a delight. Through all his teaching there ran a golden thread of high moral earnestness.

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Among the happiest recollections of those Edinburgh days are those of the Sunday afternoon hospital visits. This was one of Lister's ways of keeping the Sabbath day. The coachman and the horses had a rest. Lister came to the Infirmary on foot. The picture is plain before me now. It is the old Reserve Ward, a large ward for men, and about two o'clock on a summer afternoon. Clerks and dressers, and some students from other clinics, are standing about, chatting together, or talking to the patients. The instrument clerk, in charge of the famous spray, is seated on the broad window-sill at one end of the ward, now examining the flame of the spirit-lamp, or touching the safety-lever to let steam escape, for the spray must be kept ready for instant use; and now looking across the smoky roofs of the old town, where his eyes rest on the blue gleam of the Forth, "North Berwick Law with cone of green, and Bass amid the waters."

Then some one suddenly says, "Here comes the Chief!" and we see our hero enter through the little side-gate, pass down the slope, with his easy rapid stride, a light cane in his hand, and on his handsome face a look of happy meditation. The house-surgeon meets him at the main door, and in a few minutes they enter the ward. Students come to attention, patients' faces beam. I wonder if there were anywhere else in the world a surgeon whose pupils held him in more reverent admiration, whose patients so trusted him, loved and positively adored him. He cannot be unconscious of this feeling, the "soft lines of tranquil thought" grow softer, that "face at once benign and proud and shy" is suffused with the unaffected pleasure of this modest and simple-minded great man as he begins his tour of the ward.

It was his wish on Sunday to see every patient, and as we often had sixty or seventy, this meant a visit of three

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or four hours. He goes from bed to bed, occasionally conversing with a patient, or discussing a case with the house-surgeon, and perhaps himself changing a dressing. He draws the attention of dressers and students to clinical facts, but never using a word to alarm or distress the patient, and performing his manipulations with the gentlest, steadiest, firmest hand which any sufferer could dream possible.

And so through all the men's wards, then downstairs to the women and children. How their eyes followed him! And perhaps the visit would end in the little ward at the back of the hospital, a room really meant for one bed and one patient, but in which were two large beds; in one lay or sat, looking at picture books or playing games, three small boys, Tommy Miller, Roden Shields, and Willie Shotts, all "chronics," spines and joints, doomed to early death or at least deformity and lameness but for him; and all happy and recovering. And in the other bed, the tall, gaunt, russet-bearded figure of Henley the poet, who lay there with his limb saved, musing and framing his "Sketches in a Northern Hospital."

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Lister was fond of studying in the open air. He loved to meditate in a garden. When, in 1869, he returned to Edinburgh as Professor of Clinical Surgery, and settled at No. 9 Charlotte Square, he looked forward to meditating in the West Princes Street Gardens. "It will indeed be a grand place for the purpose when I have it all to myself before breakfast." Thirty years later we find him pacing to and fro in these gardens on the morning of the day when he was to receive the honour of the Freedom of the City and thinking over the speech he was to deliver.

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There are many intelligent people to-day who know and honour the name of Lister, and who yet have very hazy ideas of what he accomplished. The majority know of him as a great surgeon. So he was, the greatest surgeon since the world began, but they do not know why they think him so. Some know he invented a new surgical dressing. So he did, but that dressing has long been among the flotsam of Lethe. Some think he discovered carbolic acid. He adopted it as the most powerful and useful weapon in his battle with disease. His successors have discarded it. They call it poison. It is not upon a new dressing or a lotion, or even upon new methods of operation that Lister's fame rests. He was a great pioneer, he introduced new principles, he revolutionised the pathology of inflammation, he made rough and perilous paths smooth and "sweet with certainties," he opened a new and beautiful door into the House of Health, and gave us, his followers, the passport and the key.

JOHN STEWART,

Dresser, 1875; Clerk, 1876-77; House Surgeon, 1878.

VIII

THE scent of Phenol brings it back to memory, even after fifty years and more. A long, dark, stone-flagged corridor; some white caps and aprons flitting to and fro; a door opening on a ward, plainly furnished and clean; a crowd of eager lads, tense with expectation; a little group of foreigners, swarthy, bearded, bespectacled; and in the centre, Lister.

How to recall him as he stands there; stands there so curiously different from his peers! They, alert, active, practising surgeons, able men, strong, sagacious, brilliant, such as would lend distinction to any School: He, calm, serene, with the eye of a visionary; one to whom the case was not only a case of this or that, but a human being on whom a great experiment was being made, with whose fate a great theory would stand or fall.

And those two groups round him—how different they were from one another! The visitors, French, German, American, were there as critics, friendly it might be, but critical of the theory and of its practice. The students were not so much critics as partisans. How difficult at this distance of time to recover the zest, the eager hope that, after all, this message of Lister's was to encompass the world, to be a new evangel of healing! For he had us all at his feet, our Master; we were not his students so much as his disciples.

His face reveals his secret as seen in the Oules painting or the Westminster Medallion. Henley, too, has the good fortune to have sketched an Immortal in verse; and as

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Lister is for all time, so Henley's sonnet will live, so truly does it limn his features :

"Soft lines of tranquil thought his face fulfil,
His face at once benign, and proud, and shy.

His wise, rare smile, so sweet with certainties."

Lister possessed something far beyond the coldly intellectual man of science. This he derived in direct succession from the Society of Friends; and the "Inner Light" was with him still. There was a seriousness of purpose with which we were impressed from the very beginning. You were not taken on in his service until you had called on him in Charlotte Square, a sufficient ordeal, be it said, for youngsters to undergo. But the kindness and sympathy of 'The Chief' were reassuring, and one felt as if enlisted in a great cause. It was made clear to us that the whole atmosphere of class-room and of wards was imbued with the spirit of the great cause, to be carried through with enthusiasm.

His own faith was infectious. His belief in carbolic acid solution, at that time, was great. Memory recalls a little speech of his over a bleeding cup full of 1-40 solution of carbolic acid with some extraneous matter superadded; it might be blood or pus, or the like. He would explain that though the solution was "æsthetically impure," yet, owing to the antiseptic, it was "surgically pure." And then again, a case comes back to memory, one of cold abscess apparently nearing the surface. The student in charge, thinking out the situation for himself, had argued that if it were to burst into the open air "germs" would enter. He had, on his own initiative, put on a protective dressing of the kind then in use. This seems so obvious to us now; but not so then.

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When, on the following day, Lister saw this and was told what had been done, he was greatly moved. It showed him that here his ideas had found practical recognition, and one recalls the gratitude with which he thanked that young worker, now long since dead, a pioneer of the cause in the Midlands of England.

Lister's enthusiasm never disturbed his serenity. One cannot think of ever having seen that calm and beautiful face clouded by anger. If anything untoward occurred that displeased him, a look of reproach from him meant more than hot words from another. He was a man of few words; a pity rather, for the voice was musical, the accent refined, the words well chosen, while the little stammer really gave something of distinction to the utterance. It seemed more as if he were "thinking aloud" than lecturing to his audience, so wrapt he seemed in the ideas that came to him in dwelling upon this aspect and that of his great theory.

As it was in speech, so also in action. He did not aim, as did some of his colleagues, at rapidity of execution, at brilliancy of operation. Was it perhaps that he foresaw the change that was to come in consequence of his teaching, and that of Simpson on anæsthesia? That pain being abolished, and time of little consequence, new operations hitherto unthought of would emerge, where rapidity would be misplaced? In any case, both in speech and action he lived up to his teaching, "in quietness and confidence shall be your strength."

Once indeed his feelings impelled him to break through his rule of reticence. It was a great occasion, never to be forgotten by those—how many remain?—who took part in it. Rumour was busy that London was finding a place for him. In a week his students had drawn up a petition, signed by seven hundred names, praying him to remain. How to recall the wild excitement of those days! Local patriotism,

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hero worship, the sure faith that from him was emerging the greatest advance of modern times, and that we were his disciples and missionaries ; such were the well-springs of our enthusiasm. When the petition was presented to him he was visibly affected, and when at the end of his speech he said that there was nothing in London that would tempt him from them, to those eager young hearts it seemed that all was well and that they were not to be parted from their hero. How it ended is now a matter of history, but none of those who took part in that scene will ever forget it.

Looking back, it is clear that his decision was wise, even inevitable. There seems in his career the stroke of Fate, of Kismet, of Providence, call it what you will. The young Englishman of budding genius, drawn to the Scottish capital merely by interest in one who was himself the foremost surgeon of his day ; the visit is prolonged into a lifelong bond of mutual aims. Glasgow calls him, and the conditions there compel his research in the direction that we know. Edinburgh again calls him to a sphere where his genius will find more scope and a larger field than London could give. Finally, when all is complete and his own metropolis calls him, the crowning act is placed on his career of conquest. Are not all these links in a great chain that one may easily believe to have been foreordained? Who knows but that this thought may have occurred to Lister in his last years of retirement and meditation.

He was one to whom the unseen was very real. He seemed to us to touch perfection more than any other man. None of us had even heard of Nietzsche, who even then was hammering out, in fire and fury, the brazen image of the *Uebersensch*. But here, before our eyes, was a superman in the flesh, and one derived from that very source, the Christian ethic, which Nietzsche was planning to destroy.

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If human perfection be attainable, the perfect man must be physically, intellectually, and spiritually of the highest; and, if there be such, Lister was one. Handsome he was and well proportioned, but he was something more; intellectually he was a tower of strength, and his influence sprang from more than intellect. In his presence we felt that here was one, moved by no motive of desire for fame or fortune, but one who looked upon his life as dedicated to the service of God and of humanity; he ever seemed to walk "as seeing Him Who is invisible." He is a spiritual memory to all who knew him "in his habit as he lived," and, like the "Royal Dane,"

"He was a man, take him for all in all,
I shall not look upon his like again."

CHARLES E. DOUGLAS,
Dresser, 1876.

IX

IT is with some diffidence that I write a few notes of my personal recollections of Lord Lister and contribute something, however small and unworthy, in memory of the great Master who so largely influenced my life and work.

My introduction to him was in the winter of 1874, when he was at the height of his fame and popularity in Edinburgh, and six months before I began my medical studies.

My father, who was a friend of Lister's and had been House Surgeon with Syme, took me to the twelve o'clock lecture on Clinical Surgery at the Old Royal Infirmary. In the anteroom I saw the dressers preparing the spray and otherwise getting ready for an operation. Then we trooped into the theatre, which was crowded with students and where I had a front seat. The operation witnessed was the removal of the head of the radius for a partially anchylosed elbow. Lister used the chisel and hammer, explaining how these instruments were borrowed from the craft of the mason and how beautifully they worked in surgery.

It was the first lecture during the Winter Session, at which chloroform was administered, and the opportunity was taken to explain how it could be given most safely. The administration was entrusted to a student who was to pour it, "no matter how much," on to a folded towel, admitting plenty of air, watching the breathing and disregarding the pulse. During the operation respiration stopped for a few seconds and Lister at once showed his anxiety; the tongue was pulled out and soon all was well. Lister's serenity returned:

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"A false alarm, gentlemen; better a thousand false alarms than one death."

Three years later, as his dresser, I was impressed by his wonderful kindness and sympathy; by the trouble he took never to give the least unnecessary pain; and by the encouraging word spoken to each patient on the operating table. The poorest and meanest was not simply "a case" but a fellow-being with a life of supreme importance.

One Sunday he was late in coming to hospital and I happened to be the only student present. "Do you tak' your meat?" he asked of an old Scotsman, and then turned to me to explain the comprehensive word "meat," meaning food. With his gentle smile and slight stammer he quoted in illustration the words: "I have meat to eat that ye know not of."

In 1877, I, along with Watson Cheyne, John Stewart and our dear friend, James Altham, now passed away, was helping Lister during his first winter in London. It was a great privilege to us; but uphill work and a depressing time for him after the popularity and hero worship of Edinburgh. I kept a diary and may quote one or two entries from it.

4th January 1878: "Lister just returned from his holiday; he was prepared to lecture, but found no audience!"

15th January: "Lister said he occasionally felt it was not worth the 'fash' to be working as he did and with so few taking interest in his methods. Yet on second thoughts, he said that surgery was such a noble art, and the results themselves were the surgeon's reward."

4th February: "Lecture on healing by first intention: splendid!"

Some months after I left "King's" Lister wrote me a letter of four pages, which I still preserve. He said: "Do not suppose that I was not much pleased to receive your

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letter and to hear of your doings. I was also glad that you could say that you did not regret having been in London last winter. You saw me and helped me at a time when things were at a very low ebb in my wards, and when, I assure you, your cheery help was extremely welcome. . . . You can't think how pleasant it was to me to see my old Edinburgh students again on the 1st of the month at the Graduation. They gave me a hearty, indeed I may say, an almost overpowering welcome, which I shall never forget."

Socially Lister was a delightful host and full of fun. I dined with him when the guests included Marcus Beck, Watson Cheyne, Hector Cameron and Knowlsley Thornton. Lister told me he was once a teetotaller, adding after a pause, "for about a week, when I was a boy at school." He agreed in great measure with the saying that wine was the milk of old age.

Knowing that I was a lover of Natural History, he talked enthusiastically about visits to the "Zoo." It was not till I read his "Life" that I realised that he was a Field Naturalist. On page 510 there is a description and a sketch from his Diary (23rd April 1891) of a bird which he did not recognise. He calls it a *Turdida*, but from his minute description it is plainly a Whinchat. He was probably viewing it through a binocular with which it is difficult to estimate size and distance.

Lister was a master of detail in his work. I have often found myself saying in my own hospital practice, Lister taught me this or that; for example, to tear a calico bandage, to work with gauze and collodion in single layers, to syringe an ear. I have still my steam spray, which has seen work in the slums as well as in the better houses of Chester, for in the early days of my practice I should have thought it

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criminal to have opened the simplest abscess without its use ; and I have my "ear hook," which has preserved a more lasting reputation.

Finally, I have a letter inserted in my copy of Godlee's "Lord Lister." The letter is dated 2nd April 1907, and runs :—"My dear Dobie, I thank you cordially for your most kind letter ; and I congratulate you on being Surgeon to the Hospital. I am glad to get such good news of your father. Please give him my most kind remembrances, and believe me, very sincerely yours, Lister."

W. HENRY DOBIE,
Dresser and Clerk, 1877-78.

X

IN 1878, as a boy fresh from school, I entered the Medical School of King's College, London. Having completed six months' dissecting and attended lectures on anatomy and physiology, together with chemistry and botany, I was ordered to attend clinical lectures on surgery twice weekly. Whether my honoured teachers who were responsible for this scheme of instruction were wiser than they appeared to be, or whether they "builted better than they knew," is now of no consequence. I found myself an enthralled listener at Mr Lister's clinical lectures, and it did not seem to matter in the least that I was so poorly equipped with preliminary knowledge.

I was amazed to find that I was able to follow easily every word that was said; the lecturer was so deliberate and so deeply in earnest, the problems so clear-cut, so logical and inevitable the conclusions. Nothing was taken for granted, everything was explained with minute care. The initial changes in normal tissues from health to disease were described, the means of treatment hitherto within the resources of surgical science detailed; finally came a discussion of the altered outlook now opened to us through the new powers conferred on the surgeon by the adoption of antiseptic methods. So I came to know and to recognise the supreme art of the great teacher, that of making a complex and difficult subject appear simple and plain.

Apart from mere elementary surgical knowledge, there were other things of even greater value that I was enabled to learn from these lectures. I suppose that most people of

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that period, when even the blessing of anæsthesia was but newly bestowed upon mankind, would be likely to form for themselves an ideal picture of a great surgeon. He would probably be a somewhat terrifying person, one who, while traditionally tender-hearted, had nevertheless to steel himself to the suppression of all emotion; whose hand was deft and, above all, rapid; whose judgment was inspired and infallible, or must at least be made to appear so. Here on the contrary was a man very courteous, very gentle and almost painfully sensitive, simple and single-hearted in his worship of the Truth; and it was an exceedingly fortunate lad who came early into his hands as a pupil.

In order to understand Lister's method of teaching, we must remember that he was attacking an ancient problem that had hitherto set at defiance all human endeavour; and he was treading a path under the guidance of a new lamp of science that as yet burned very low. His problem was to control the behaviour of wounds, and to disarm them of their power of generating poisonous substances of deadly virulence. These he was satisfied were produced by germs which existed practically everywhere, including the dust of the air. The bare foundations of the modern science of bacteriology were being laid in those days; but from the nature of his great conception which was in the near future to change the whole face of surgery, his mind was at that time, as it was for ever after, concentrated upon methods of dressing wounds. Thus, it is not without significance that his earliest steps took the line of securing aseptic results in wounds already made—in compound fractures; and from the first, wonderful to relate, he seems to have been successful in eliminating infection from these injuries, so that they were enabled to pursue the benign course of simple fractures.

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His conception of what constituted antiseptic dressing was not merely the employment of one that was sterile, and that should be applied without contaminating the wound in the process; his demand was for a systematic procedure capable, first, of establishing asepticity in a wound, and secondly, of maintaining it for an unlimited time, even if need be for months. Hence it would seem that, in order of importance, the dressing of wounds came first; next the aseptic making of wounds; and then followed, in due order, the wholesale innovation and almost limitless extension of the surgical field that we have in mind when we employ the term "modern surgery."

We may now see clearly the reason for a striking peculiarity of Lister's teaching method. He gave two clinical lectures each week, and they were real clinical lectures although, instead of taking the class to the bedside, the patient was brought to the class in the lecture theatre which was also the operating theatre. Then surgeon and patient sat side by side in the area; the patient was encouraged to tell his or her story, the salient points of the case were indicated in as few words as possible, and the patient then retired while the history and the appropriate treatment were discussed. If the operation required were a short one, it would be performed then and there, and there was then given a minutely detailed demonstration of the method of dressing the case.

Lister never talked surgery at the bedside; the publicity of the ward, and his dislike of discussing symptoms, diagnostic features and operative questions in the hearing of the patients seemed to forbid it. He showed, however, no such reluctance to deal with the minutest details of surgical dressing and the reasons underlying every step in the process, together with carefully thought-out devices for furthering the comfort of

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the patient. All such matters were dwelt upon endlessly. He visited his wards every day, Sunday included, so that it is not difficult to make a rough calculation showing that about 75 per cent. of his teaching must have been devoted to the details of surgical dressing, and the remaining 25 per cent. to what, for brevity, I will call "Text-book surgery."

My pupilage under Lister was in the days of the carbolic spray and gauze dressings. The spray irritated the tissues somewhat and caused a profuse flow of sanguineous serum for some hours after the operation, so that all cases had to be drained. In operations on bones the wound was left unsutured and gaping and allowed to heal by organisation of blood-clot. Spinal abscesses were prize cases for demonstrating, at once, the technique and the power of aseptic or, as it was then always called, antiseptic management; but inconvenience arose through the occupation of the beds for many months. The abscesses were treated by incision, evacuation, and rubber-tube drainage. During the first twenty-four hours a profuse flow of serous fluid took place from the cavity, washing out the remains of the "pus" into the dressing; during the next twenty-four hours there would be much less, and the amount rapidly diminished until the dressing interval could be extended to forty-eight hours, then to three days, and very shortly there was so little discharge that change of dressing was only needed once a week. From that time the case was dressed once weekly during many months, and every dressing was conducted with meticulous ritual. For instance, the most scrupulous care was taken that no air that was unpurified by the spray should reach the wound; even the tube, after its washing in carbolic solution, was held in the spray before being reintroduced, in order to blow out the air that was in it and substitute carbolised air. The dressing was fixed

Joseph, Baron Lister

in its place by means of bandages, elastic webbing and safety-pins, so securely that it could not be displaced the fraction of an inch during its week of duty.

I hear the objection, "We know better nowadays; we have better ways of treating spinal abscesses than by draining them, and we know that uncarbolic air is harmless." My point, however, is concerned with the efficiency of the dressing. Do we feel that we could dress a drained spinal abscess for two years in that or any other way, without access of infection? It is curious to notice that, at the present day, it seems taken for granted that the introduction of a drainage-tube into an uninfected wound or a joint is to be shunned on account of the liability to infection associated with the use of the drainage-tube. The deduction is obvious. The healing of a wound by organisation of blood-clot is a thing very rarely seen to-day; with us it was a familiar occurrence.

Volkmann came to see Lister's work, and, on being shown a wound healing by organisation of blood-clot, expressed at once his astonishment and complete conversion to Lister's principles. He also uttered the striking observation that in the face of such evidence, statistics were not needed. The truth is that Lister was the greatest master of the science and art of dressing wounds that the world has ever seen; he occupied and still occupies a lonely pinnacle to which no predecessor led up, and to which no successor has ever aspired. I hope I may state without being misunderstood, that outside the rapidly thinning ranks of those whom he taught, it is very difficult for present-day surgeons to realise the extent and perfection of his achievement as a "dresser."

Lister was profoundly interested in chloroform administration, in which he had at one time undertaken a good deal of

Reminiscences of 'The Chief'

research work ; and he wrote the best articles ever contributed to the subject from the practical standpoint in Holmes' *System of Surgery* (1883). He taught his clerks himself with infinite care and took the entire responsibility while they were giving it. The guiding principles were a model of simplicity ; shortly stated, they were concerned with proper dilution of the vapour, unobstructed freedom of respiration, and recognition of the stages of anæsthesia. On the negative side, the heart and pulse were disregarded, and it was forbidden either to listen to the one or to feel the other during the operation. Not the least of Lister's achievements must be reckoned that of sending out into practice an army of first-rate administrators whom he had himself taught to give chloroform confidently and safely.

Before closing these "Memories," I feel desirous of saying something regarding the character of the man as I saw it. There was nothing of the ascetic about Lister ; both body and mind were too robust. He enjoyed congenial society, and he took pleasure in dispensing generous hospitality. Yet withal he was deeply and unaffectedly devout ; and I think we have been inclined to ascribe too much of this quality in his character to his Quaker upbringing. His simple, childlike faith was apparently untroubled by scientific questionings, and there was in his mind no need for any conflict between science and religion ; still less could there be either rivalry or even a line of separation between the worship of his Maker and the service of his fellow-men. The all-absorbing pursuit of the profession of healing was for him "Pure religion and undefiled," and all other forms of observance, devout churchgoer though he was, held only second place to that which he seemed to have been sent into the world to teach. This view of him was strikingly illustrated by a few arresting words of rebuke I once heard him utter in the operating theatre. Some onlookers were

Joseph, Baron Lister

talking during the performance of an operation, and Lister turned to them with the grave words—"I ask you to remember this place is Holy; more so than any church. Silence, if you please."

Lister, it need hardly be said, was a lover of children. Of the many "great moments" that came, often quite suddenly, while listening to him, there is one that has always seemed to me the most moving, as its memory has been the most treasured. The occasion was a clinical lecture and the subject was a little child. After discussing the operative indications and what was best to be done, he went on somewhat as follows:—"We must remember that when the patient is a child, our responsibilities are rendered all the heavier thereby. An adult has the power of deciding whether he will submit to any course we may propose, or decline it. He can thus share with us some, at least, of our responsibility. But children are powerless in our hands; and this should make us all the more cautious in anything we undertake to do to their sacred little bodies."

Lister was, I rejoice in believing, a very happy man; happy in his glorious work, and in the enjoyment of domestic sympathy and peace, pure and without alloy. No other encouragement, help and support, could have approached that given to him by his gentle, loving wife, who gave herself without flagging to the task of sharing and lightening his heavy burden of work. The world will never know its debt to this noble woman for her share in the laying of the foundations of modern surgery. Those, however, who are able to remember her, will know very well indeed that any account of Lister and his work would be hopelessly wanting were not a humble tribute of veneration and gratitude offered to her memory.

R. HAMILTON RUSSELL,
House Surgeon, 1883-84.

VII

LETTERS

TO M. LOUIS PASTEUR, acknowledging the debt which Surgery owed to his researches.

9 CHARLOTTE SQUARE, EDINBURGH,
13th February 1874.

MY DEAR SIR,—Allow me to beg your acceptance of a pamphlet, which I send by the same post, containing an account of some investigations into the subject which you have done so much to elucidate, the germ theory of fermentative changes. I flatter myself that you may read with some interest what I have written on the organism which you were the first to describe in your *Mémoire sur la fermentation appelée lactique*.

I do not know whether the records of British Surgery ever meet your eye. If so, you will have seen from time to time notices of the antiseptic system of treatment, which I have been labouring for the last nine years to bring to perfection.

Allow me to take this opportunity to tender you my most cordial thanks for having, by your brilliant researches, demonstrated to me the truth of the germ theory of putrefaction, and thus furnished me with the principle upon which alone the antiseptic system can be carried out. Should you at any time visit Edinburgh, it would, I believe, give you sincere gratification to see at our hospital how largely mankind is being benefited by your labours.

I need hardly add that it would afford me the highest gratification to show you how greatly Surgery is indebted to you.

Forgive the freedom with which a common love of science inspires me, and, believe me, with profound respect,

Yours very sincerely,

JOSEPH LISTER.

Joseph, Baron Lister

To Professor JOHN CHIENE, as President of the Royal College of Surgeons of Edinburgh, accepting the award of the Liston-Victoria Jubilee Prize in the gift of the College.

12 PARK CRESCENT, PORTLAND PLACE,
LONDON, *12th December 1897.*

MY DEAR CHIENE,—I feel much touched and gratified by the desire of the Committee that the next award of the Liston Prize should be to me.

If the Council generally should be of the same opinion, I shall accept the Prize with affectionate gratitude, believe me,

Most truly yours,

LISTER.

To Dr DAVID CHRISTISON, containing remarks upon the existence of malaria in Britain.

12 PARK CRESCENT, PORTLAND PLACE,
LONDON, *8th March 1901.*

MY DEAR CHRISTISON,—Your letter is very welcome, except what you say about your hands. It would be a great loss both for the Society of Antiquaries and for yourself if you had to give up the Secretaryship. But let us hope that Harrogate will work wonders both for you and for Mrs Christison.

The portion of the "Proceedings" which you have sent must have been the result of a great deal of work of a very agreeable kind; and from what I have seen as yet, there is much more than a grain to the ounce of interest in it.

What a terrible blow the Queen's death was. Yet it seemed to come at about the right time, and all passed much as could have been wished. I was in the St George's Chapel at Windsor at the funeral. It was a wonderful sight. I rather regret that I did not see the wonderful naval pageant in the Solent. Had I known that it was going to be such a glorious day as to weather, I should, I daresay, have gone. You had not told me of the amusing service I unconsciously did for your nephew.

The King has made a wonderfully good and auspicious beginning. I only hope he will not become "weary in well doing." He certainly has an onerous task before him.

Letters

I am glad to see from your report that our friend Beddoe is still able to carry on the work at which he was so assiduous when we were Residents together in the Old Infirmary. We did not then think he was going to work with such effect as he has done. He has won for himself a very distinguished place among anthropologists.

I hope the bairns I saw at your house, on that eventful day nearly two years ago, are quite well.

Please remember me very kindly to Mrs Christison, and, believe me,

Yours ever truly,

LISTER.

12 PARK CRESCENT, PORTLAND PLACE,
LONDON, 4th February 1902.

MY DEAR CHRISTISON,—I thank you for your paper concluding the account of your long continued investigations. It is remarkable how specially inimical a town atmosphere is to Coniferæ. In the Botanic Garden here trees generally thrive very well; but the Coniferæ are utterly wretched.

It is interesting that the natives of Somaliland had come to so clear an opinion as to the agency of mosquitoes in relation to malaria. It had been *suspected* by Laveran, the discoverer of the parasite, and by others after him. But the *proof* that the insect was the medium of conveying the parasite, and of the manner of its action, was given by Ross.

The disappearance of malaria from the English fen country is no doubt due to the improved drainage. This will not only greatly diminish the number of mosquitoes, but, as Ross has pointed out, the effect of this diminution upon the number of persons infected through their agency will be to reduce the number in a duplicate ratio. Then if there are fewer infected mosquitoes, there will be less chance of the same person being bitten many times over. I do not know whether it has been ascertained whether biting again and again by mosquitoes infected with the same variety of the malarial parasites produces an exaggerated state of the disease. But we do certainly know that a man may have a mixed infection, *i.e.*, may have two different forms of the parasite in him at the same time; the result, no doubt, of his having been bitten by mosquitoes differently affected.

The genus *Anopheles*, which conveys malaria, has various species,

Joseph, Baron Lister

differing much in size, etc.; and there are known to be plenty of these species distributed over this country, though they no longer convey malaria, as there are no malarious patients for them to bite.

I must end this long talk and beg you to believe me, with very kind regards to Mrs Christison,

Yours ever truly,

LISTER.

To Principal Sir WILLIAM TURNER, describing various gifts presented to the University of Edinburgh for preservation.

12 PARK CRESCENT, PORTLAND PLACE,
1st February 1905.

MY DEAR TURNER,—I am pleased to think that the old High School, where Mr Syme worked as a school-boy and where he afterwards taught Clinical Surgery, is to be allowed to stand and will become part of the University premises.

Speaking of Mr Syme, I possess some striking illustrations of his surgical character, which I should like to transfer to the Museum of the University of Edinburgh. They refer to the famous case of huge fibro-cartilaginous tumour of the lower jaw, described by Mr Syme in the *Edinburgh Medical and Surgical Journal* for 1828, and reproduced in his "Contributions to the Pathology and Practice of Surgery." They are:—

(1) A beautifully prepared and mounted skeleton of the tumour. I am sorry to see on looking at it to-day for the first time for many years, that the fine black dust of London has got in during its 27 years' stay here, in spite of a well-fitting glass case, and has much darkened the once beautiful whiteness of the preparation. Still it is well worth having in the Museum.

(2) A coloured plaster cast of the head of the patient before the operation.

(3) A portrait in oils of the patient, also before the operation. I did not know of the existence of this till after Mr Syme's death, when I found it in a cupboard in his consulting room. The fact that he had this portrait taken as well as the cast shows the great importance he attached to the case, and also the confidence with which his sound pathological knowledge enabled him to look forward

Letters

to success. This is all the more remarkable considering that Liston had refused to touch the case three and a half years before, and also that Mr Syme, whose years went with the century, was a very young man. I have always understood that he was 27 years old at the time of the operation. The reference to the *Medical and Surgical Journal* in the "Contributions" does not mention the date of publication further than the year (1828). This could no doubt be cleared up by looking at the *Journal* in the University library. But whether he was 27 or 28 years old, he was very young. His skill and judgment as an operator are also well shown by this case, particularly when his account of it is read.

The patient, Robert Penman, afterwards went to America, and came over on a visit to Scotland during the early time of my first stay in Edinburgh, about 1855, or nearly thirty years after operation, in perfect health and with the deformity wonderfully masked by a bushy beard. I have a photograph of him taken at that time, and I should like it to go with the other things.

I have also a very beautiful preparation of "infantile hernia" from a case occurring in Mr Syme's private practice, also in my early Edinburgh time. He sent it to the University Museum, where the preparation was made by Dr Cobbold, at that time Curator. Afterwards, at Mr Syme's request, it was given to me; but it is only right that it should go back to Edinburgh.

I have given directions to my executors that these things should be sent there on my decease. But I feel that there would be very great risk of the skeleton of the tumour and the hernia preparation being spoiled before they arrive at their destination. It has occurred to me that perhaps your son here would take charge of them in one of his visits to you. The cast can of course go with ordinary luggage, and the portrait in oils, being not very large and with a very simple frame, will present no difficulty; but the skeleton of the tumour and the hernia preparation would be ruined if the box in which they will be packed is not kept scrupulously with top side up (standing on the floor of the cab or railway compartment). If you approve, I will write to Dr Aldren and ask him to call here and see the things and then I will get them packed and left for him to call for either now or at any other time, as he may prefer.

This has been a long story, and my being able to tell it is no

Joseph, Baron Lister

doubt an indication that I am stronger than I was some months ago. But I am bound to say, with reference to your kind remark about my health, that I am far indeed from complete recovery.

Ever truly yours,

LISTER.

12 PARK CRESCENT, PORTLAND PLACE,
22nd February 1905.

MY DEAR TURNER,—I have to-day handed over to your son's kindly keeping the articles connected with Mr Syme, about which I wrote to you. I have added two others about which I leave you to act with perfect freedom as to whether it is worth while to keep them or either of them.

One is a preparation made by Goodsir for Mr Syme to show the relation of the arteries of the bulb to the operation of median urethrotomy for stricture.

The other is an effigy in marble of Mr Syme's right hand. It was made from a plaster cast which Dr John Brown persuaded Mr Syme to have taken. It belonged to Dr Brown, whose autograph "dextra magistri" appears in the label upon it. Dr Brown gave it to me when we left Edinburgh in 1877, and it has been lying ever since wrapped in thick cotton wool. Whether the pale brown colour of the marble is due to London dust penetrating the wool or whether it was acquired during Dr Brown's possession of ten years or so, I do not know. The former seems hardly possible. I suppose a little soap and water would restore the original whiteness. Both these objects are of purely historic interest. The University of Pavia has in its museum the right thumb and index of Scarpa preserved in spirit, and it is possible you may think this marble worth putting with the other things in the Museum. But I feel quite undecided myself and, as I said before, I trust that you will do exactly as you think best about this and Goodsir's preparation, not a very grand one in itself, though it has historic interest from its connection with the two men.

Excuse this long story and, believe me,

Ever truly yours,

LISTER.

Letters

12 PARK CRESCENT, PORTLAND PLACE,
2nd March 1905.

MY DEAR TURNER,—I was much obliged to you for your last letter.

As regards the things for the Museum, the cast, which is wrapped in paper and directed, may be packed with clothes in a portmanteau and cannot go wrong. The picture too, being not a large one, and also packed and directed, is a very simple matter.

The other things of course need special care; but all that is needful for the journey is that the not large box containing them be kept with the top up. Direction as to this is given in large letters, and your son is, I think, fully alive to the importance of the matter. So that for the *journey*, he might perfectly well, I think, be entrusted with them, when he goes to see you in the spring on which we have now entered.

But in the unpacking of the box your personal care would be very desirable. The marble effigy of the hand could not be put on its side, as there was not room for that, and stands on the wrist with the fingers upwards. It is wrapped in cotton wool and covered with brown paper; and in taking out this parcel it should *not* be taken by the top, as that would run great risk of the forefinger on the marble knife being broken off. If the hands are slipped down to the bottom of the parcel and it be lifted up by that, there will be no danger.

The putting in of the marble hand was an after-thought and I had got the box arranged for the other things only; otherwise I would have had the box a little larger. However, if what I have said is borne in mind, all will be right.

Please excuse me for inflicting so long a story upon you, and believe me,

Ever truly yours,

LISTER.

12 PARK CRESCENT, PORTLAND PLACE,
25th July 1907.

MY DEAR TURNER,—I have received in the course of my life a number of medals from learned Societies and other Bodies, diplomas of membership of many learned Bodies, and other honorary gifts;

Joseph, Baron Lister

it has been a matter of much anxiety to me to whose custody they should pass after my decease.

The last received is a gold box conveying the Freedom of the City of London. It seems natural that this should remain in London, and I propose to bequeath this to the College of Surgeons of England.

It occurs to me that the University of Edinburgh might be willing to accept the casket containing a corresponding document regarding the Freedom of the City of Edinburgh.

And this having suggested itself, I have wondered whether the University would care to receive the medals, diplomas, etc., to which I have referred. This would be on the understanding that the University authorities would be at full liberty to destroy any of the documents, sell any or all of the medals, and dispose of any of the other articles as they may think fit.

I trust to your giving your candid opinion regarding this proposal, which I make with great hesitation.—Believe me,

Sincerely yours,

LISTER.

12 PARK CRESCENT, PORTLAND PLACE,
LONDON, *27th July 1907.*

MY DEAR TURNER,—Since I wrote to you on the 25th, I have decided that, if the University should approve of my proposal made in that letter, I would add the gold casket conveying the Freedom of the City of London to the things which I offered to bequeath to the University of Edinburgh.

My sympathies have never been with a merely examining body, but with a teaching University, and above all with that of Edinburgh. It was thanks to its very liberal and wise policy regarding the extra-academical school that I was induced to teach Surgery when a very young man; and this led to my work on Inflammation which was the essential preliminary to that on the Antiseptic Principle. And I need hardly say how near my heart Edinburgh became during the Professorship of Clinical Surgery.

Hence though at first it seemed natural that the casket referring to the London Freedom should remain in London, I should much prefer that it should go to Edinburgh.

Letters

This of course would be in case my proposal should be acceptable to the University authorities; and I can quite understand that the arrangement may not be thought a suitable one.—Believe me,

Very sincerely yours,

LISTER.

AVENEL, MELROSE,
29th July 1907.

MY DEAR LISTER,—As I left Edinburgh on Friday after the “Capping” on that morning, delay occurred in the receipt of your letters of 25th and 27th, and therefore in the acknowledgment of them.

I have been much impressed with the warmth of your feeling towards the University of Edinburgh, and with your desire to present to it the valuable caskets which you received, along with the freedom of the two cities, from London and Edinburgh, together with the diplomas, medals and other honorary gifts made to you.

I can I feel sure speak for the University Court and Senatus that they will greatly appreciate your gift and treasure it in memory of a Professor whose life-work will for ever associate the University and Medical School of the city with the discovery of one of the greatest benefits bestowed on suffering humanity.

In this respect I would venture to suggest that in your deed of gift you should not give “full liberty to destroy any of the documents, sell any or all of the medals.” The collection in my judgment should be preserved in its entirety and not broken up or destroyed.

Very truly yours,

WM. TURNER.

12 PARK CRESCENT, PORTLAND PLACE,
31st July 1907.

MY DEAR TURNER,—Your letter has touched me deeply. I intend to act in accordance with your advice.

Yours affectionately,

LISTER.

Joseph, Baron Lister

To Sir GEORGE A. BERRY, acknowledging the Congratulatory Address from the former members of his Staff in the Old Royal Infirmary, Edinburgh, on the occasion of his 80th birthday.

12, PARK CRESCENT,
PORTLAND PLACE.

18 Apr / 07

My dear Berry

I thank you from my heart for your share in the beautiful Address which I have received from former members of my Staff in the Old Infirmary.

Of all the multitude of birthday congratulations which I have received, none, I assure you, has touched me more deeply.

Believe me

very sincerely yours
Lister

Letters

To Professor JOHN CHIENE, C.B., with remarks on sulpho-chromic catgut and carbolic acid.

18 PARK CRESCENT, PORTLAND PLACE,
LONDON, *5th May* 1908.

MY DEAR CHIENE,—I thank you for your letter and for the trouble you took in sending me a sample of your catgut.

In my very feeble state, I must ask you to excuse the unavoidable inadequacy of my reply.

The preparation of the sulpho-chromic gut is, when one has arranged the details, a matter of the utmost simplicity. And it is surely much more convenient to have it in dry hanks than in bottles. If properly used, it is certain never to give any trouble. I never in my long experience with it had any reason to suspect it. Of course, like the instruments, it may have septic material adhering to its surface; but this is effectually disposed of by placing it, like the instruments, for a short time (say $\frac{1}{4}$ hour) in carbolic acid solution (1 to 20).

The idea of carbolic acid, as used in our practice, being “a most deleterious compound” is, as you must be abundantly aware, an utter mistake.

When applied, as it was at first, with great freedom to the cut surface of the wound, it had the disadvantage of causing needless irritation and consequent free serous discharge, requiring large provision for drainage during the first few days; but it never had any toxic or other hurtful action.

The spray, as a substitute for washing of the wound, had the great advantage of causing much less irritation and so of enabling us to do with very much less drainage. And when, in 1890, a consideration of the uniform success of the spray in empyema, in spite of the extremely attenuated form in which we used it, furnished me with absolute demonstration of what I had long suspected, that the atmospheric dust might be entirely disregarded both in old fashioned hospitals and in private houses, it became in any given case simply a question whether the surgeon could trust himself and his assistants sufficiently to enable him to avoid any antiseptic application whatever to the cut surface of the wound. For *well*

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squeezed sponges can hardly be said to apply the antiseptic to the wound.

People attribute faults in their results to defects in the means used, when they are really the consequence of their not using earnest, intelligent vigilance against septic contamination by themselves.

Perhaps you may not be aware that Mr Syme published in the *Lancet* of 1854-55 clinical lectures which he gave during that period. I was then his House Surgeon, and it fell to my lot to report them ; but he always read every lecture over before it was published. I may add that the illustrations to these lectures were taken from sketches of mine. These lectures would afford ample subject for comment in lectures by yourself. But you must forgive me for expressing a doubt whether the reports of Mr Beveridge would be a very desirable subject for such discourses.

A few minutes' conversation would have been incomparably more satisfactory than this letter.

Yours ever very sincerely,

LISTER.



THE RESIDENTS, SUMMER 1854, OLD ROYAL

JOHN KIRK	GEORGE HOGARTH PRINGLE	DAVID CHILDS	ALEXANDER STRUTHER
JOSEPH LINDEN	PATRICK HEWES WALTON		

JOHN HOODGE

VIII

LISTER'S FELLOW-RESIDENTS, SUMMER 1854

AS we glance at the group of men photographed together in the summer of 1854, we almost instinctively ask ourselves this question: What were the careers of Lister's six associates, who, like himself, stood on the threshold of their professional life? The following brief sketches will supply the answer.

In the spring of the same year Great Britain had declared war against Russia. Then, as in more recent times, a special call was made upon the medical profession. In order to relieve the regular army surgeons for duty at the seat of war, a Civil Hospital staff was formed largely from the young physicians and surgeons who had just vacated hospital appointments. Alexander Struthers, George Hogarth Pringle, John Beddoe, David Christison and John Kirk volunteered for service. Patrick Heron Watson joined the Army Medical Corps and, after a period spent at Woolwich, was appointed Assistant Surgeon to the Royal Artillery and sent direct to the Crimea.

ALEXANDER STRUTHERS arrived at Scutari on the shores of the Bosphorus on the 4th November, 1854, and at once commenced his hospital duties. On Christmas Day he was struck down with a severe attack of remittent fever, from which he succumbed during the month of January.

Joseph, Baron Lister

He was buried in the British Soldiers' Cemetery, overlooking the Sea of Marmora.

A tablet erected by a few brother officers, old fellow-students in Edinburgh, bears the following simple inscription :—

Sacred
to the Memory of
ALEXANDER STRUTHERS, M.D.
of Edinburgh,
who died at Scutari,
20th January, 1855,
while discharging his duties as
Assistant Surgeon,
aged 25 years.

In a letter to John Struthers, then teaching anatomy in the Extramural School in Edinburgh, John Beddoe writes from the British Hospital, Dardanelles: "Of your poor brother, everybody who knew him spoke in the highest terms. There is no doubt that great as was the pressure of work thrown upon him in the crowded and disorderly state of the hospitals, his conscientious anxiety led him to over-exert himself."

Gifted and accomplished as a student, Struthers had given evidence of much promise but, in the service of his country, his career had been all too early cut short.

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During the Crimean War, GEORGE HOGARTH PRINGLE acted as surgeon on a transport conveying the sick and injured from the lines to the Base Hospitals at Scutari and Renkioi. After peace had been declared, life at sea continued to attract him, and as ship-surgeon on the boats

Lister's Fellow-Residents

of the Cunard and "P. & O." lines he made several voyages to Australia.

In 1860, Pringle settled in Parramatta in New South Wales, where he built up an extensive practice and held several appointments in Government institutions. The experience gained in his pre-war days as house-surgeon under Syme and Spence had developed in him the love of surgery. As one of the pioneers of the Listerian methods in the Antipodes, Pringle upheld the principles and faithfully carried out the practice of his former fellow-resident. He was elected a Fellow of the Royal College of Surgeons of Edinburgh.

While on a voyage to the old country in 1872, he died on Easter Day, aged 41. Thus the sea, which had appealed to him in his earlier years, again claimed him, becoming his last resting-place.

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PATRICK HERON WATSON, invalided home from the Crimea in 1856, soon commenced to lay the foundation of his long and successful surgical career. Appointed to the Staff of the Royal Infirmary, Edinburgh, first as Assistant-Surgeon and then as Surgeon, he served that institution for a period of twenty-six years. He became a Fellow of the Royal College of Surgeons of Edinburgh in 1855, and was twice elected to the Presidential Chair, first in 1877-78 and again in 1905, in the Quatercentenary year of the College.

As a Lecturer on Surgery in the School of Medicine and later as a clinical teacher he attained marked success, attracting the student not only by his powers as a diagnostician and by his dexterity and brilliance as an operator, but by his impressive and dignified personality. He was a pioneer in more than one field of surgery,

Joseph, Baron Lister

devising and carrying out operations which have now become well recognised procedures.

Heron Watson was a man of affairs with a profound knowledge of his fellow-men, and his services were in much demand outside his purely professional work. As an active member of the Commission appointed under the Universities (Scotland) Act of 1889, he was closely identified with the reorganisation of the Scottish Universities. As representative of his College for nearly twenty-five years on the General Medical Council and as a member of the University Court, he was well versed in the various aspects of University education and administration.

During his long life many honours came to him. An Honorary Surgeon in Scotland to two Sovereigns, he received, in 1903, the distinction of Knighthood from King Edward VII. By the Royal College of Surgeons in Ireland he was made an Honorary Fellow, and the University of Edinburgh bestowed on him the Honorary Degree of Doctor of Laws.

He died on the 21st December 1907, aged 75 years.

Few members of the medical profession have lived more strenuous, more varied and successful lives, combining, as he did, surgery and the practice of medicine with a number of administrative posts.

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JOHN BEDDOE, like Lister, was an Englishman, and before coming to Edinburgh, where he graduated, he received some of his early medical education at University College, London.

Settling in Clifton, after his return from the Dardanelles, he was appointed physician to the Bristol Royal Infirmary, in which institution he was a colleague of Edward Long Fox.

Lister's Fellow-Residents

Beddoe soon had a large practice, from which he finally retired about 1890.

As a young man he had become attracted to the study of Anthropology and, as early as 1853, the year of his graduation, he published his *Contributions to Scottish Ethnology*. His various researches in anthropological science brought him many distinctions and honorary appointments, his work being recognised and valued both at home and abroad. His *Races of Britain* at the time of publication was the standard authority on the subject. He was elected a Fellow of the Royal Society and the University of Edinburgh conferred on him the Honorary LL.D. Like his friend, David Christison, with whom he was connected by marriage, he delivered the Rhind Lectures in Edinburgh in 1890, taking as his subject, "The Anthropological History of Europe."

At a comparatively early age Beddoe presented a somewhat venerable appearance, but mentally he never grew old. In his *Memories of Eighty Years*, published shortly before his death, there is abundant evidence of his intellectual and physical vigour and of the many-sided character of his interests in life.

Beddoe died on the 15th July 1911, in the 85th year of his age. Three of his old fellow-residents of 1854 survived him at that period.

As the result of illness contracted during service in the Near East, DAVID CHRISTISON on his return home was unable at first to take up the duties of his profession. After an interval of time, however, he became private physician to the second Lord Ashburton, and on the death of the latter, in 1864, Christison returned to Edinburgh, where he assisted his father, Sir Robert, in some of his routine medical work.

Joseph, Baron Lister

He became a Fellow of the Royal College of Physicians of Edinburgh.

As a student of antiquity, the science of Archæology had long interested him more than the practice of physic, and after the death of his father, in 1882, he devoted himself almost entirely to its study. In the ancient moats, camps and forts with which the map of his native land is so thickly studded, Christison found a congenial occupation, and his laborious and detailed survey of these placed him among the pioneer workers in archæology in this country. His skill with pencil and paint brush enabled him to illustrate a small volume on Scottish Churchyard Monuments, which appeared from his pen.

He was elected Secretary to the Royal Society of Antiquaries of Scotland, an appointment which he retained for sixteen years. Christison delivered the Rhind Lectures in Archæology, taking as his subject, "The Prehistoric Forts of Scotland." In 1906, his University bestowed upon him the Honorary Degree of Doctor of Laws.

In the memorial window commemorating, in 1891, the opening of the Antiquarian Society's Museum in the National Portrait Gallery in Queen Street, Christison's portrait-medallion is placed along with those of his colleagues holding office in the Society.

Quiet, unassuming, and with a charm of manner which attracted his friends to him, David Christison passed away on the 21st January 1912, at the ripe age of 82, thus pre-deceasing by three weeks his old fellow-resident, Joseph Lister.

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In the spring of 1858, David Livingstone was making preparations for his second journey to East Africa. JOHN

Lister's Fellow-Residents

KIRK, on the recommendation of his former teacher in Botany, John Hutton Balfour, obtained the post of surgeon and naturalist to the expedition.

Then followed five years of romantic adventure. The discovery of Lake Nyasa and the great trek south-westward along the Zambesi River to the Victoria Falls provided Kirk with ample opportunity of developing his botanical gifts. He enriched the herbarium at Kew with the flora of Tropical Africa, and he was the means of adding to the British Pharmacopœia the *Strophanthus Hispidus*, the deadly Mangunju arrow-poison. He rendered signal service to his colleagues by his medical skill, and he was mainly responsible for bringing the expedition to a successful termination.

In 1866, having recovered from his temporary ill-health, Kirk was appointed medical officer to the Consulate at Zanzibar, but his powers as an administrator destined him for other duties, and in course of time the British Foreign Office gave him the status of Consul. In this position, by his courage and tact he obtained a remarkable influence over the Sultan Said Barghesh, and thus secured the abolition of the slave trade in the Sultan's Dominions. "Where the slave market once stood at Zanzibar—and how many times have I seen it thronged with captive Africans—there now stands a cathedral." Surely a fitting tribute to the work of a son of the manse!

In all the negotiations with Germany which resulted in the assigning to that country of the great territory to which Zanzibar was the door of entry, Kirk acquitted himself with a sincere desire to uphold the interests of his country and the welfare of the native races. He was Plenipotentiary in Brussels at the African conference on the slave trade and, in 1895, he was sent as Special Commissioner to Nigeria, where he successfully dealt with the native troubles. His

Joseph, Baron Lister

distinguished services were rewarded with the dignity of a G.C.M.G., and, in 1890, he was created K.C.B. He was elected a Fellow of the Royal Society and his *Alma Mater* conferred upon him the Honorary LL.D.

David Livingstone and John Kirk were medical pioneers, and Kirk took his share in blazing the trail which so many others have followed. He died at Sevenoaks in Kent on the 16th January 1922, at the age of 89, the last survivor of the small group of Residents of 1854.

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A few salient facts arrest the attention as we glance at the careers of this remarkable group of men.

Six of the seven in their youth saw war service. With the exception of two whom death claimed early, five passed the allotted span of three score years and ten and earned the worldly rewards of high endeavour.

Upon five, the University of Edinburgh conferred the Honorary Degree of Doctor of Laws. Three, as the award of great scientific merit, became Fellows of the Royal Society. The reigning Sovereign invested three with titular honours, a Knighthood, the Grand Cross of St Michael and St George and a Peerage respectively. On three, distinction was bestowed not in acknowledgment of purely professional service but in virtue of a reputation gained by one as an anthropologist, by another as an archæologist, and by the third in the sphere of diplomacy.

A. LOGAN TURNER.

“ When the ear heard him, then it blessed him, and when the eye saw him it gave witness of him. He delivered the poor that cried, the fatherless, and him that had none to help him. Kindness, meekness and comfort were on his tongue. If there was any virtue, and if there was any praise, he thought on these things. His body is buried in peace, but his name liveth for evermore.”

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